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Minuteman–Charles River Bikeway Connector Feasibility Study

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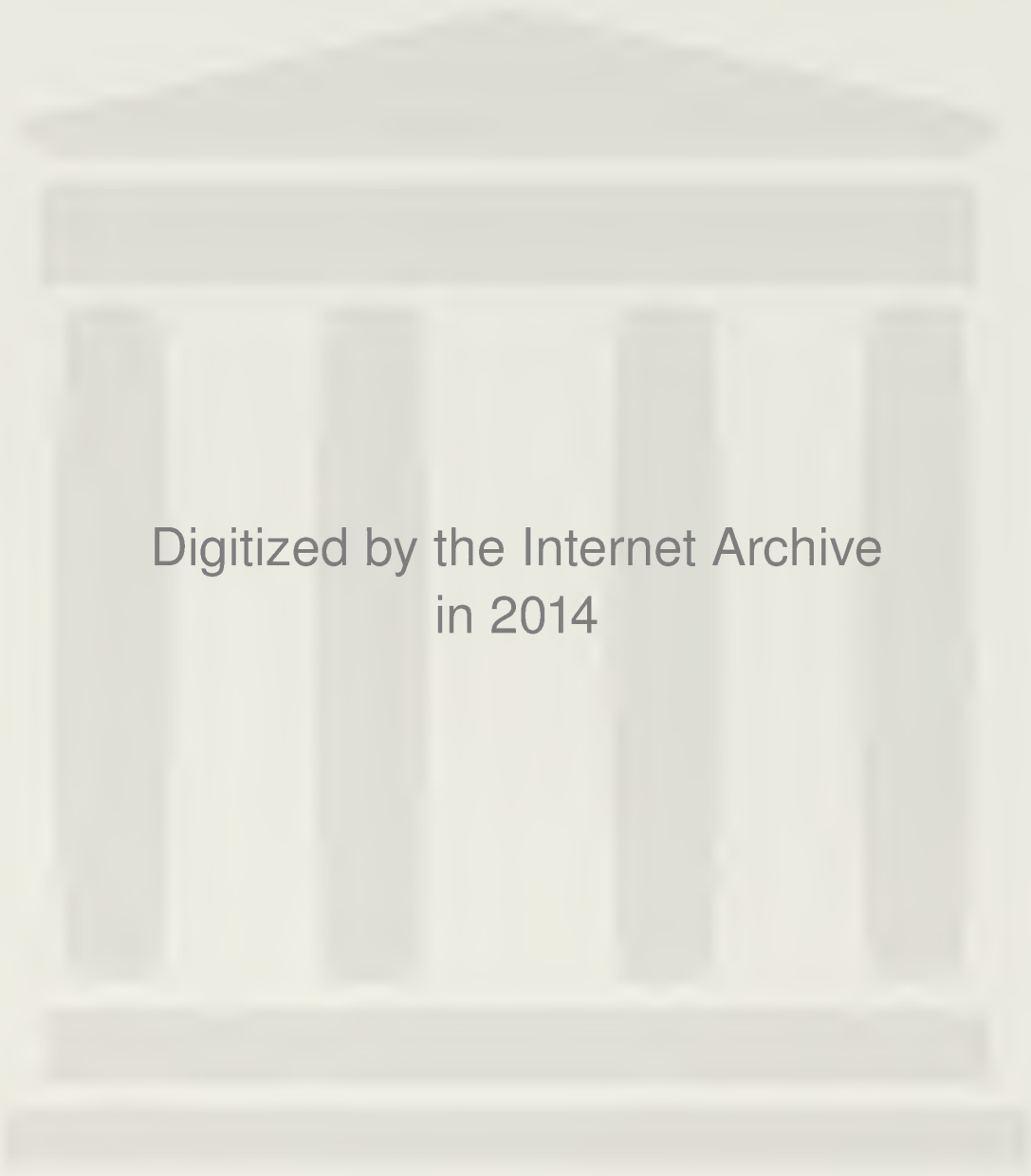
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Minuteman–Charles River Bikeway Connector Feasibility Study

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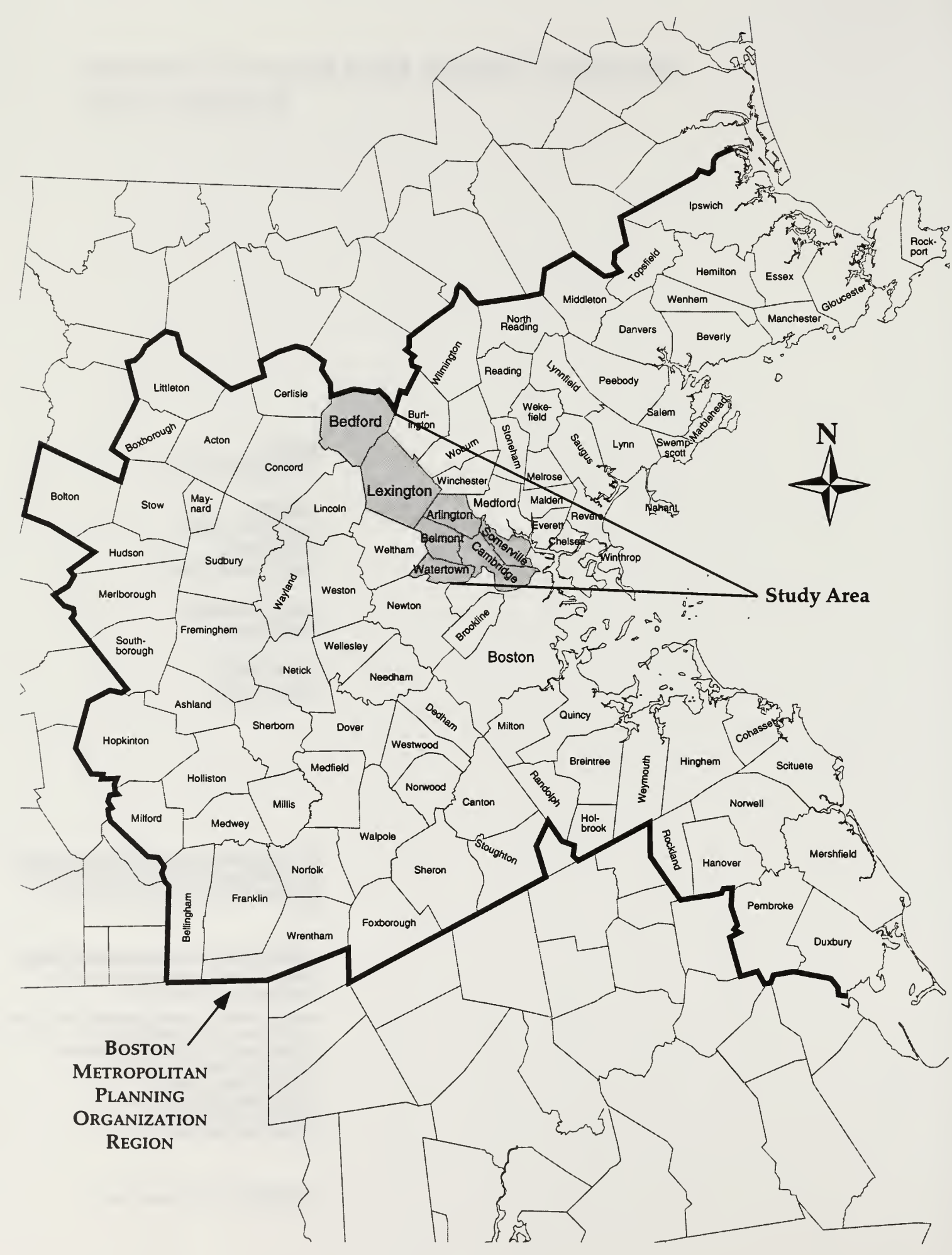
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Executive Summary

The mandate of this study is to find a way or ways to connect the two most popular paths in the metropolitan Boston area. These two trails are the Dr. Paul Dudley White Bicycle Path, which goes from the Charles River Dam at the Museum of Science to Watertown Square, on both sides of the Charles River, and the Minuteman Commuter Bikeway, which goes from the Alewife area of Cambridge through Arlington and Lexington to Bedford. Both on-road and off-road alternatives were studied.

The area between these two paths is densely populated, and there is significant commercial activity in the Alewife area. Major arterials in the area act as barriers, with no provisions for pedestrian-type crossings. Specifically, Concord Avenue and Fresh Pond Parkway cut the Fresh Pond shopping center off from the Fresh Pond Reservation, a major recreational resource in Cambridge. Both of these roads have high traffic volumes, especially in the peak commuter hours. There is a stretch of about one mile where there are no provisions to cross these roads safely. Likewise, at the Charles River end, Memorial Drive, another major arterial, must be crossed. There is a stretch of almost a mile west of JFK Street with no pedestrian crossings. This is the area where the on-road alternatives would connect to the Dr. Paul Dudley White path.

The major recommendation of this study is that pedestrian crossings be provided to lessen the barrier impact that these arterials are now having on non-motorized users.

All of the off-road alternatives need to be pursued further. None is ideal. The only one that is fairly direct is along the Watertown Branch rail right-of-way, which still carries active freight, albeit infrequently. Joint use is a possibility; width restrictions at the bridges are the primary physical obstacle. The other major off-road alternative is a path along Alewife Parkway and the Mystic River Parkway. The third off-road recommendation is a short segment west of Alewife towards Belmont which would be an improved connection to Alewife for those west of the station area. Another off-road alternative looked at in the study is a path parallel to the rail main line in Somerville, connecting to the Charles River in Charlestown. Although this alternative would be an excellent trail connection, it is problematic in terms of available right-of-way.

For on-road alternatives, several routes are possible. One would proceed from the Alewife area to the Fresh Pond Reservation to the bicycle lanes on Huron

Avenue, then follow Sparks Street to Mount Auburn Street to the river. Another would proceed through the Fresh Pond Shopping Center to Danehy Park to a neighborhood street such as Fayerweather to the river. A more long-term alternative would utilize a proposed pedestrian overpass of the main line railroad tracks to reach Danehy Park from Russell Field. Several alternatives are being recommended because the nature of each is very different and they would serve different markets. Priorities and detailed designs remain to be worked out by Cambridge residents and staff members, as all the on-road alternatives are in the city of Cambridge.

Introduction

This study results from federal legislation passed in 1991 called the Intermodal Surface Transportation Efficiency Act (ISTEA). This legislation included a project "to plan and construct a bicycle and pedestrian path connecting Arlington, Cambridge, and Boston, Massachusetts" (Section 1104, Congestion Relief Projects, Item 22). The understood purpose of this "path" is to connect the Minuteman Commuter Bikeway to the Dr. Paul Dudley White Bicycle Path on the Charles River. This project was included in the ISTEA legislation at the behest of U.S. Representative Joseph P. Kennedy.

This study was done with input from an advisory committee composed of representatives from the affected communities and from appropriate agencies. The communities and their representatives are the following:

Arlington:	Alan McClennen, Jr.
Belmont:	Jeffrey Wheeler
Bedford:	Charles Schwerin
Boston:	Andrew McClurg
Cambridge:	Cara Seiderman
Lexington:	Carolyn Levi
Somerville:	Sherri Geldersma, Todd Fontanella
Watertown:	Janet Jameson

The agencies involved were the Bureau of Transportation Planning and Development (BTP&D) of the Executive Office of Transportation and Construction (EOTC), the Massachusetts Bay Transportation Authority (MBTA), the Metropolitan District Commission (MDC), and the Metropolitan Area Planning Council (MAPC). Agency representatives were the following:

BTP&D:	Josh Lehman
MAPC:	Joan Blaustein
MBTA:	Jane O'Brien, Erik Scheier
MDC:	John Krajovic, David Queeley, Dan Driscoll

Finally, the advisory committee included the Bicycle Coalition of Massachusetts (BCOM), represented by Jack Johnson and Doug Mink.

Any trail facilities recommended in this study are intended not only for bicyclists and pedestrians but also for skaters (roller skaters and in-line skaters),

joggers, baby carriages, and wheelchair users: in short, all non-motorized users (motorized wheelchairs are allowed). On-road connections are discussed in terms of bicyclists. In Massachusetts, bicyclists are legally entitled to use all roads except those that specifically deny bicycles (such as limited-access highways).

Finding a trail connection (the terms path and trail will be used interchangeably in this report) between the two paths is desirable because there are many people who would not use an on-road connection. It was decided early on in this study, however, that on-road alternatives also need to be included. Certain users, such as commuting bicyclists, might prefer on-road alternatives because they may be faster. They may be faster because they are more direct or because traffic congestion on a path necessitates slower speeds than the road system generally allows.

The on-road alternatives are intended for bicyclists. The distance between the Minuteman and Dr. Paul Dudley White paths is over two miles. Most pedestrians would opt for the very convenient public transportation connection. Those interested in walking have many routes available.

The first chapter of this report describes existing conditions in the study area, including traffic counts, done on the Minuteman path and the road system, and bicycle and pedestrian accident data. The next two chapters present the alternatives, first on-road, then off-road. The final chapter makes recommendations.

1 Existing Conditions

The two most popular trails in the Metropolitan Boston area are the Dr. Paul Dudley White Bicycle Path and the Minuteman Commuter Bikeway. (See Figure 1.) This study was conducted to find the best way or ways to connect these two facilities.

The alternatives that have been studied are both on-road and off-road. On-road means use of existing roads, with possible improvements. Off-road means the use of facilities separated from motor-vehicle traffic, such as railroad rights-of-way.

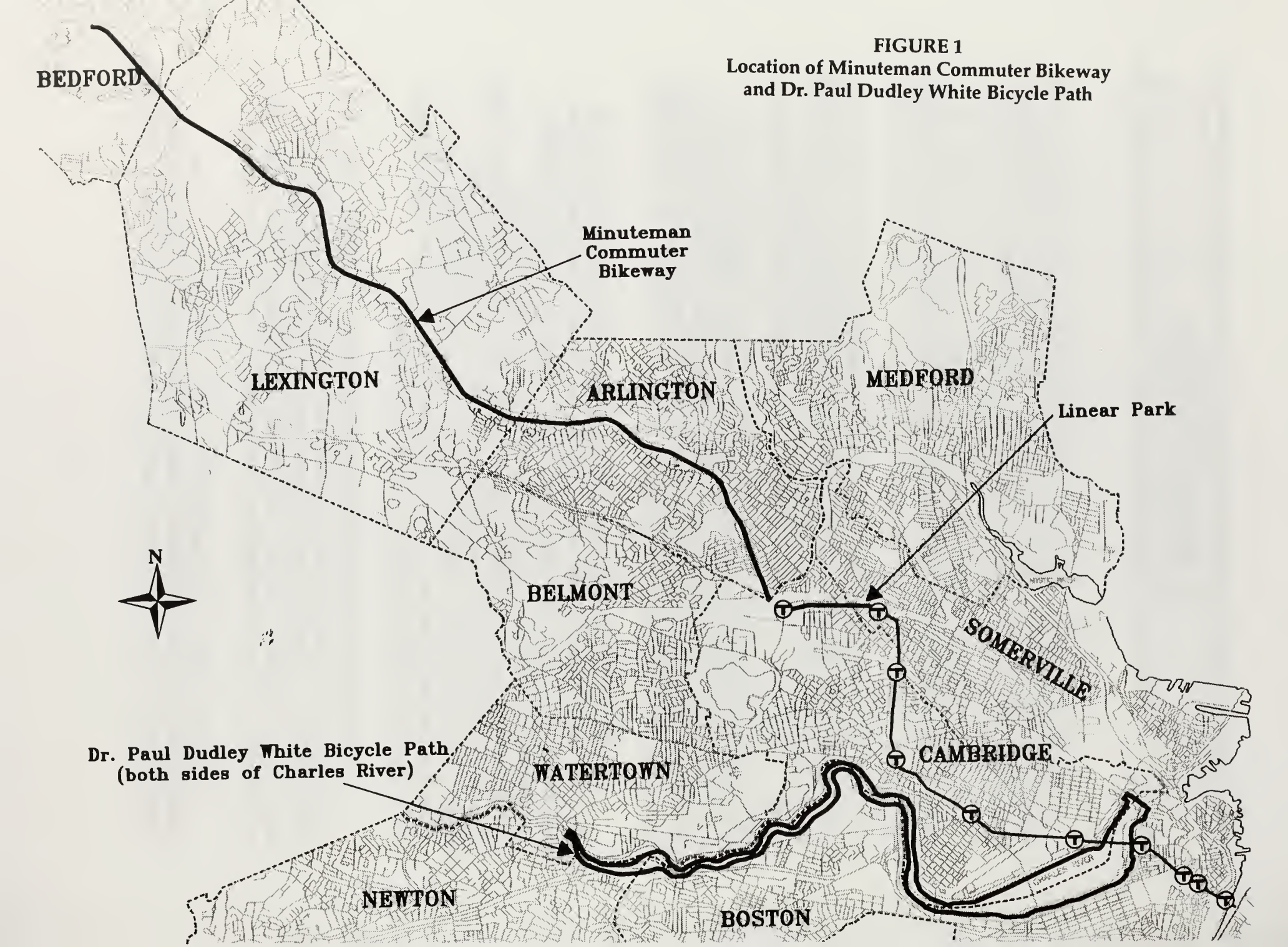
The Dr. Paul Dudley White Bicycle Path, located on both sides of the Charles River, extends from the Charles River Dam in Boston to Watertown Square. On the south side of the river, starting from the dam, it extends along the Esplanade, parallel to Storrow Drive, goes past Boston University (B.U.) and under the B.U. Bridge. It continues along Soldier's Field Road through Allston and then along Nonantum Road in Newton to Watertown Square. On the north side, from the dam, it parallels Memorial Drive and Greenough Boulevard in Cambridge and continues in Watertown along Charles River Road to the Square. The total length on both sides of the river is about 18 miles.

The Dr. Paul Dudley White paths were constructed in phases from 1972 to 1982. The design standards that were applied then are not the same as those that exist today. As a result, some improvements are needed, such as widening some sections, improving horizontal sight distances in areas, and eliminating obstructions within or immediately adjacent to the path. While the objective of this project is to identify a way to connect the river paths to the Minuteman, it is important to address the fact that this river path system needs attention. Any connections between these two paths will increase usage and make improvements on the Dr. Paul Dudley White paths even more imperative.

The Minuteman Commuter Bikeway was dedicated in November 1993. It is an eleven-mile path built on the Lexington Branch right-of-way (also called the Bedford Branch). It extends from Arlington, near the Alewife MBTA station, to Loomis Street in Bedford. Its only discontinuity is in Arlington Center, where users are required to use two side streets and a short stretch of Massachusetts Avenue.

These two paths are the major facilities in the Boston region for non-motorized use. They serve a myriad of users: bicyclists, joggers, walkers, skaters, wheelchair users, rollerskiers, babies in carriages, tricyclists, skateboarders. Within a

FIGURE 1
Location of Minuteman Commuter Bikeway
and Dr. Paul Dudley White Bicycle Path



particular user group there are a host of types. Among bicyclists, for example, there are experienced commuters, touring, recreational and utilitarian cyclists, and children. Among those walking there are families out for an afternoon hike, people taking a brisk two-mile walk, and those walking to their job or an MBTA station.

A. Alewife Station Area

Throughout this report, "Alewife Station" will be used interchangeably with "the Minuteman Bikeway" to denote the area that is to be connected to the Charles River paths. The fact that the Minuteman provides access to Alewife greatly enhances its usefulness. Alewife Station is the terminus of the Red Line, which provides rapid transit service to Harvard Square, downtown Boston, and points south.

As of the writing of this report, the Minuteman trail ends about one-half mile short of Alewife Station. The connection from the trail to the station consists of a paved section through the Thorndike Field area to the bridge under Route 2, and then a sidewalk along an access ramp. Path users must cross the road leading to Routes 2 and 16 at-grade to reach the station.

There are problems with this gap between the station and the Minuteman. Counts done in September 1993, May 1994, and September 1995 indicate that the sidewalk width from the Route 2 underpass to the station is inadequate to safely provide for the volumes of bicycle and pedestrian traffic attracted to the station. Also, there are inadequate provisions for crossing the at-grade intersection adjacent to the station. This is especially critical during the PM peak period, when motor-vehicle volumes are highest.

The counts done in this area show a ratio of pedestrians to bicyclists of about three-to-one (303 compared to 98 in 1993). The 1993 counts were done in the AM peak period; the 1994 and 1995 counts were done in the PM peak period. The spring 1994 counts were about 20 percent higher than the 1993 counts; the fall 1995 bicycle counts were 41 percent higher than those from 1994. (Detailed summaries of these counts may be found in Appendix A.)

The city of Cambridge and the town of Arlington have funded the design of the extension of the Minuteman path to Alewife. This design will alleviate the serious sidewalk width problem mentioned above. Some improvements will be made at the intersection itself. The construction contract for this work is scheduled to be awarded late this year by the Massachusetts Highway Department (MHD). Additional remedies will be addressed in an MHD design-construction contract, scheduled to begin in late 1996. There are other design issues in the Alewife Station area to be addressed in the MHD contract, including improved access from Alewife Station to the Linear Park in Davis Square.

B. Bicycle Traffic Volumes

Bicycle counts have been done in the Minuteman corridor since 1980. These counts were done for two reasons. First, the counts were the basis for estimates of bicycle volumes on the then-proposed Minuteman Commuter Bikeway. Second, the counts provide a basis for before-after comparisons. Further pre-construction counts were conducted in 1985, 1990, and 1993. All counts were done during PM-peak commuter hours, on a Tuesday or Wednesday, between September 24 and October 1. Counts were conducted at nine intersections in 1980; seven of those were repeated in 1985, 1990, and 1993. In the 1993 counts, seven locations on the Minuteman Commuter Bikeway were added. At that time, the bikeway was not officially open but was being used. Additional counts were done in the spring of 1994, six months after the official opening. A final series of counts was done in September 1995, the first of the five-year series (1980, 1985, 1990, 1995) that is an "after" count.

Table 1 indicates the changes in on-road volumes for the years 1980 through 1995. As can be seen, the overall volumes from 1980 to 1985 to 1990 remained essentially the same. The 1993 overall volume is unchanged, although all intersections experienced decreases between 1990 and 1993 except two: (1) Blanchard Road at Concord Avenue in Belmont and (2) Arlington Center. There has been considerable variation at Blanchard Road at Concord Avenue through the six sample counts, and the counts are relatively low. At Arlington Center there is a discontinuity in the path, so that count also includes bicyclists entering and leaving the path. The volumes in 1994 and 1995 are higher, with increases continuing in Arlington Center.

Shown in Table 2 are 1993, 1994, and 1995 peak-hour volumes recorded on the Minuteman Commuter Bikeway itself. Two interesting comparisons can be made: (1) path versus street volumes and (2) total volumes in 1993 (including path traffic) versus street-only volumes in the pre-construction years.

Massachusetts Avenue at Marrett Road, for example, indicates a peak-hour drop of 50 percent from 1990 to 1993, from 38 to 18 bicyclists. The closest intersection on the path that was monitored was Maple Street, where 123 peak-hour bicyclists were counted in 1993. Almost seven times as many bicyclists used the path in this vicinity as used the road system. Adding these peak-hour bicyclists on the path at Maple Street and the on-road bicyclists at Massachusetts Avenue yields a total of 141, almost four times the 1990 peak-hour volume on Massachusetts Avenue at Marrett Road (38 bicyclists).

TABLE 1
PM Peak-Hour Bicycle Traffic Volumes,
Selected Intersections, Minuteman Corridor
9/24/80, 10/1/85, 9/26/90, 9/28/93, 5/24/94, 9/27/95

Location	Wed 9/24/80	Tues 10/1/85	Wed 9/26/90	Tues 9/28/93	Tues 5/24/94	Wed 9/27/95
Cambridge						
Porter Square	135	181	196	176	187	196
Arlington						
Massachusetts Avenue at Alewife Brook Parkway	68	72	64	61	76	78
Arlington Center	79	80	64	110	130	187
Belmont						
Concord Avenue at Blanchard	57	26	16	26	31	24
Lexington						
Mass. Ave. at Marrett Road	49	40	38	18	38	30
Bedford						
Hartwell at Maguire Road	14	5	11	9	2	0
Total	**402**	**404**	**389**	**400**	**464**	**515**

TABLE 2
Minuteman Path Bicycle Volumes,
Selected Days in 1993, 1994, 1995,
PM Peak Hour, Two-Way

	Tuesday 9/28/93	Tuesday 5/24/94	Wednesday 9/27/95
Minuteman Path at:			
Lake Street	N.A.	167	129
Arlington Center	68	94	91
Mill Street	N.A.	172	194
Maple Street	123	216	127
Woburn Street	83	296	127
Hancock Street	80	153	108
Bedford Street (4-225)	93	122	87
Hartwell Avenue	79	N.A.	72
South Street	41	61	110

In 1995, during the PM peak hour, there were 30 bicyclists on Massachusetts Avenue at Marrett Road and 127 on the path at Maple Road. There were therefore over four times as many cyclists on the path as on the road. The total PM peak-hour count for both locations was 157 bicyclists, a fourfold increase over the last pre-construction count (1990).

These data suggest two things: (1) the path is deemed more desirable than the adjacent road system by a significant portion of bicyclists and (2) the path has generated a large number of new bicycle trips.

C. Types of Users

Indicated in Table 3 are the different types of users found on the Minuteman Path. The predominant use shown in the counts is bicycling: 55 to 70 percent of the users at each of the five intersections counted in 1993 were bicyclists. The next most popular mode were those on roller-skates or in-line skates (these two categories were counted together), representing 14 to 18 percent of the users. Next were pedestrians (nine to 20 percent), followed by joggers (four to 11 percent) and other users such as people in wheelchairs and babies in carriages (up to three percent).

These counts were done during peak commuter use, when the percentage of bicyclists relative to other users might be expected to be higher. However, as shown in Table 4, counts taken on the Minuteman Bikeway on weekends and holidays indicated similar proportions of bicyclists. The counts were done at various locations in Arlington, Lexington, and Bedford, at various times of day.

In each count, more than half the users were bicyclists, from 55 to 82 percent. The next largest share of users was skaters in four of the seven counts; in the other three counts, pedestrians were the next largest share. The skater share varied from seven to 24 percent. The pedestrian share varied from five to 20 percent. A count done on the Esplanade at the Harvard Bridge, on Saturday, June 11, 1994, from 2:30 to 4:00 PM, showed 49 percent bicyclists, 30 percent skaters, 15 percent walkers, and five percent joggers.

It is interesting that there is a perception on the part of many (through anecdotal information) that there are more skaters than bicyclists. These data suggest otherwise.

D. Conflicts

There has been a great deal of discussion about conflicts among different types of users. A stripe was put down the middle of the Minuteman to encourage traffic to stay to the right; users say this measure is helpful. The major perceived problems are that some bicyclists and skaters go at speeds in excess of what other users,

TABLE 3
Counts at Five Locations,
Lexington Portion of Minuteman Path,
Tuesday, September 28, 1993

Peak-Period Users (4:00-6:30 PM)

Users by Category	Minuteman Path at: Bedford St. #	Bedford St. % of Total	Hancock St. #	Hancock St. % of Total	Woburn St. #	Woburn St. % of Total	Maple St. #	Maple St. % of Total	Bow St. #	Bow St. % of Total
Bicyclists	176	70	148	64	167	58	221	61	202	55
Pedestrians	24	9	32	14	58	20	47	13	59	16
Joggers	14	6	9	4	11	4	31	8	40	11
Roller Skaters	35	14	39	17	43	15	62	17	66	18
Other	4	2	5	2	9	3	4	1	0	0
All Users	253	101%	233	101%	288	100%	365	100%	367	100%

Peak-Hour Users

	Minuteman Path at: Bedford St.	Hancock St.	Woburn St.	Maple St.	Bow St.
Time Peak Hour Began	5:30 PM	5:15 PM	5:15 PM	5:30 PM	5:30 PM
All users	138	125	131	180	183
Bicyclists Only					
Eastbound	43	43	45	57	44
Westbound	50	43	38	66	55
Total	93	86	83	123	99
% of users who are bicyclists	67	69	63	68	54

TABLE 4
Selected Weekend and Holiday Counts
Various Minuteman Bicycle Path Locations
Percentage of Users by Type

Day of Week:	Sunday	Monday Memorial Day	Saturday	Saturday	Sunday	Monday Patriots' Day	Saturday
Date:	5/14/94	5/30/94	6/11/94	6/11/94	10/23/94	4/17/95	10/14/95
Location:	Spy Pond	Hancock Street	Lake Street	Woburn Street	Spy Pond	Bedford	Meriam Street
Time Period:	5:30-6:30 PM	2:00-3:00 PM	2:30-4:00 PM	2:30-4:00 PM	3:40-4:40 PM	10:00 AM-5:00 PM	11:30 AM-1:00 PM
Total # of Users:	358	678	356	678	205	966	597
Type of User							
Bicyclists	55%	82%	77%	77%	73%	64%	60%
Skaters	16%	11%	9%	15%	7%	24%	21%
Pedestrians	20%	7%	12%	6%	16%	5%	18%
Joggers	6%	0%	2%	0%	4%	2%	0%
Other	3%	0%	0%	2%	1%	5%	0%
Total*	100%	100%	100%	100%	101%	100%	99%

*Not all totals add up to 100 percent, due to rounding.

especially pedestrians, find comfortable. From the bicyclists' perspective, some skaters and walkers occupy so much space across the path as to make passing difficult.

On the Minuteman path and along most of the Charles River path, passing conditions are excellent during periods of low usage. This is not the case for some narrow sections of the latter facility, including the portion just east of Cambridge Street, Boston, near the Guest Suites hotel.

During peak-use periods, there are fewer opportunities to pass and probably a wider range of capability and training among the users. Paths like the Minuteman and the Dr. Paul Dudley White are rare in the metropolitan area so they attract not only local users but many from further away. In the short term, the de facto solution to the congestion problem is that the bikeway has become increasingly impractical for fast users because of user volumes. Most fast users honor this situation and either stay off or slow down. In the long term, as more such facilities are built in the area, the pressure on the existing ones may decrease. If only a few more trails are built, however, increasing popularity might more than offset the increased number of opportunities available.

Additional information about Minuteman users was obtained from a survey conducted of bicyclists only. The number of respondents was limited (35); the results, although not statistically significant, yield interesting information. The survey was administered in the fall of 1994, during weekdays from 3:00 to 6:00 PM, and respondents' answers were recorded in person by a staff member.

Two-thirds of the bicyclists were in their 30s and 40s. Sixty-two percent wore helmets. Two-thirds were commuting, one-quarter were bicycling for recreation. The average one-way trip length as estimated by the cyclists themselves was just under eight miles. Ten percent bicycled four months a year or less, and 45 percent bicycled nine months a year or more.

In terms of choosing the bicycle as a mode of transportation, 55 percent always had access to an automobile. One out of three would have driven alone if they could not have bicycled that day. More information on the survey results is included in Appendix B.

E. Accident Data

Bicycle and pedestrian accident data were available for the years 1989-1991 inclusive. These data were compiled by the Massachusetts Registry of Motor Vehicles and provided to CTPS by the Bureau of Transportation Planning and Development. The bicycle and pedestrian accidents are mapped and discussed by community. It should be noted that not all accidents that occurred are shown on the

maps. Many accidents, especially those that do not involve motor vehicles, are not even reported. Also, many reported accidents lack sufficient information to be mapped.

The following table summarizes these data by community.

TABLE 5
Pedestrian and Bicycle Accidents,
Study Area Communities,
1989-1991 Inclusive

	Accidents				
	Fatal		Non-Fatal		
	Pedestrian	Bicycle	Pedestrian	Bicycle	Total
Arlington	3	0	43	51	97
Belmont	3	0	28	35	66
Cambridge	4	0	348	283	635
Somerville	6	0	269	130	405
Watertown	3	0	81	23	107
Total	**19**	**0**	**769**	**522**	**1,310**

As indicated, there were nineteen pedestrian fatalities during this three-year period and no bicycle fatalities. There were 769 pedestrian accidents and 522 bicycle accidents, for a total of over 1,300. Given the characteristics of the communities, it is not surprising that most of the accidents occurred in Somerville and Cambridge.

Figures 2 through 6 are maps of the bicycle and pedestrian accidents by community. These maps were prepared using the CTPS geographic information system (GIS). Not all accidents have been mapped. Only those were mapped where sufficient information existed to place the accident geographically. (Of the 19 fatalities indicated in Table 5, for example, only eight are mapped.)

In some cases no accident concentrations will be seen. In other cases, specific intersections or roads will be seen to attract more than their share of accidents. The location of accidents may be a reflection of volumes of pedestrian and bicycle traffic as well as hazardous conditions. *That is, it may be that the accidents are occurring where the activity is occurring.* An intersection with a large number of accidents may be equally safe from a design point of view as another with no accidents: one is located where many bicyclists and pedestrians travel, another where little such traffic occurs.

This is not to say that nothing needs to be done. On the contrary, measures need to be taken to reduce these accidents. It is important to determine what type of measures - special signage, targeted police enforcement, traffic control, design changes - would be most effective. This is the type of analysis that would be done best by a local bicycle committee and local staff.

Watertown

Figure 2 indicates bicycle and pedestrian accidents in Watertown. Looking first at pedestrian accidents, the major location was in Watertown Square, where five occurred. Other areas with concentrations were Waverly Avenue (four), Arsenal Street (five), and Mount Auburn, especially between School and Grove streets (three). It is noteworthy that almost all of these accidents occurred on busy main streets.

The bicycle accidents were not as concentrated as the pedestrian accidents, although almost one-third of those mapped occurred on Main Street, from Watertown Square to the Waltham line. Several occurred on Belmont Street, near School Street (along the border with the town of Belmont). Several occurred on Mount Auburn Street and two occurred on North Beacon Street. The other four were scattered.

Belmont

In Belmont (see Figure 3), Trapelo Road turned out to be the worst location for pedestrian accidents, with eight located there. Two were on Belmont Street (in addition to the three recorded on Belmont Street in the Watertown records), three in Belmont Center, two on Cross Street; the rest were scattered.

As for bicycle accidents in Belmont, a number occurred on the Belmont Street/Trapelo Road corridor (nine). Four occurred on Waverly Street, two on Concord Avenue. The rest were found throughout the town, although none occurred west of Pleasant Street (Route 60), where population density is much lower and there is no commercial activity. (Only one pedestrian accident occurred in this area).

Arlington

Arlington accidents are shown in Figure 4. There were three fatalities, all pedestrians. One occurred on Hillside Avenue; that was the only pedestrian or bicycle accident in the southwest part of town. Another occurred on Warren Street. The third fatality occurred on Massachusetts Avenue, where the bulk of the pedestrian accidents occurred (20 of 32). Several other pedestrian accidents occurred on Broadway.

More than three out of five (30 of 49) of the bicycle accidents occurred on Massachusetts Avenue. It should be remembered that these accidents occurred

FIGURE 2
Bicycle and Pedestrian Accidents with Automobiles, Town of Watertown, as Reported for the Years 1989, 1990, & 1991

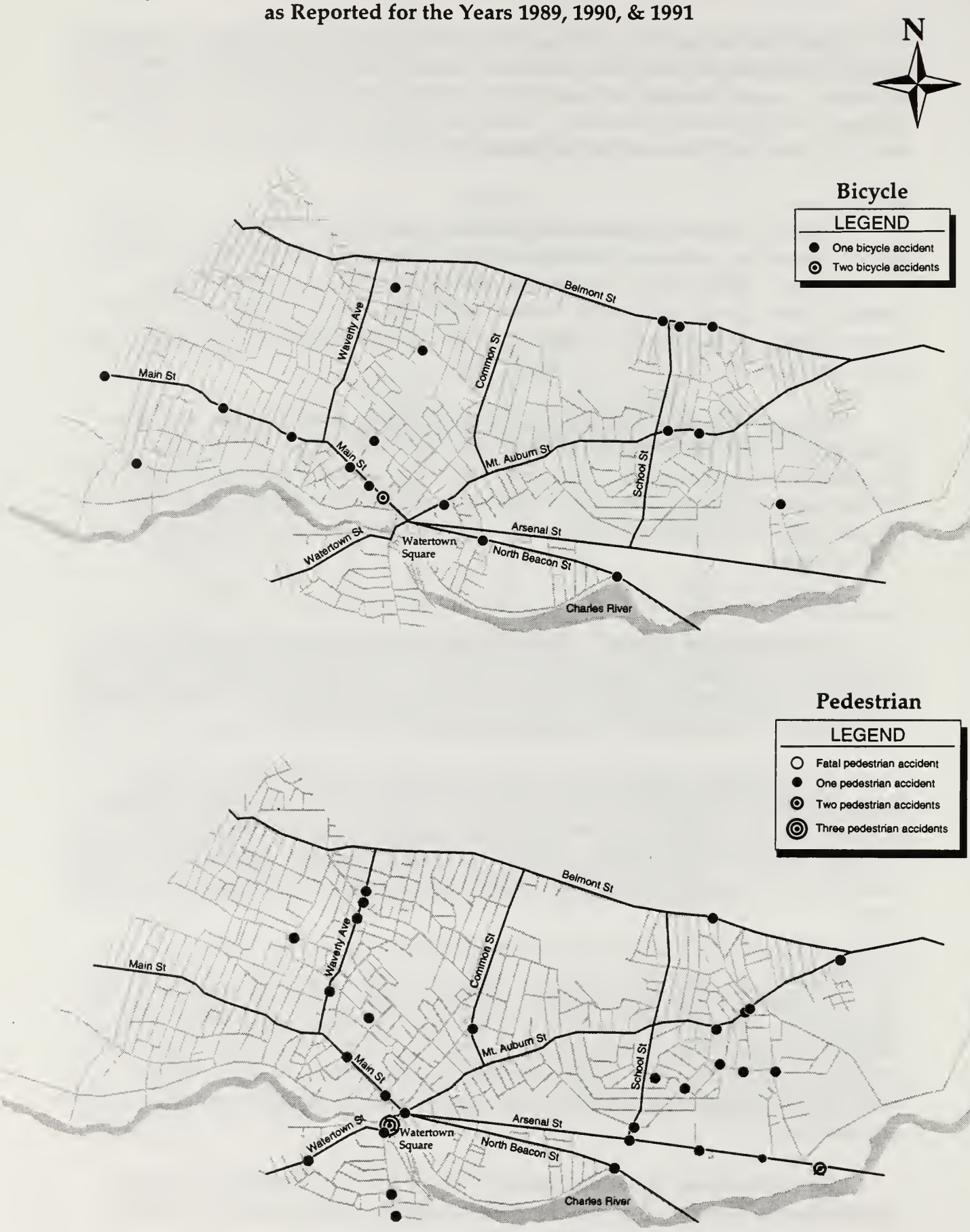


FIGURE 3
Bicycle and Pedestrian Accidents with Automobiles, Town of Belmont, as Reported for the Years 1989, 1990, & 1991

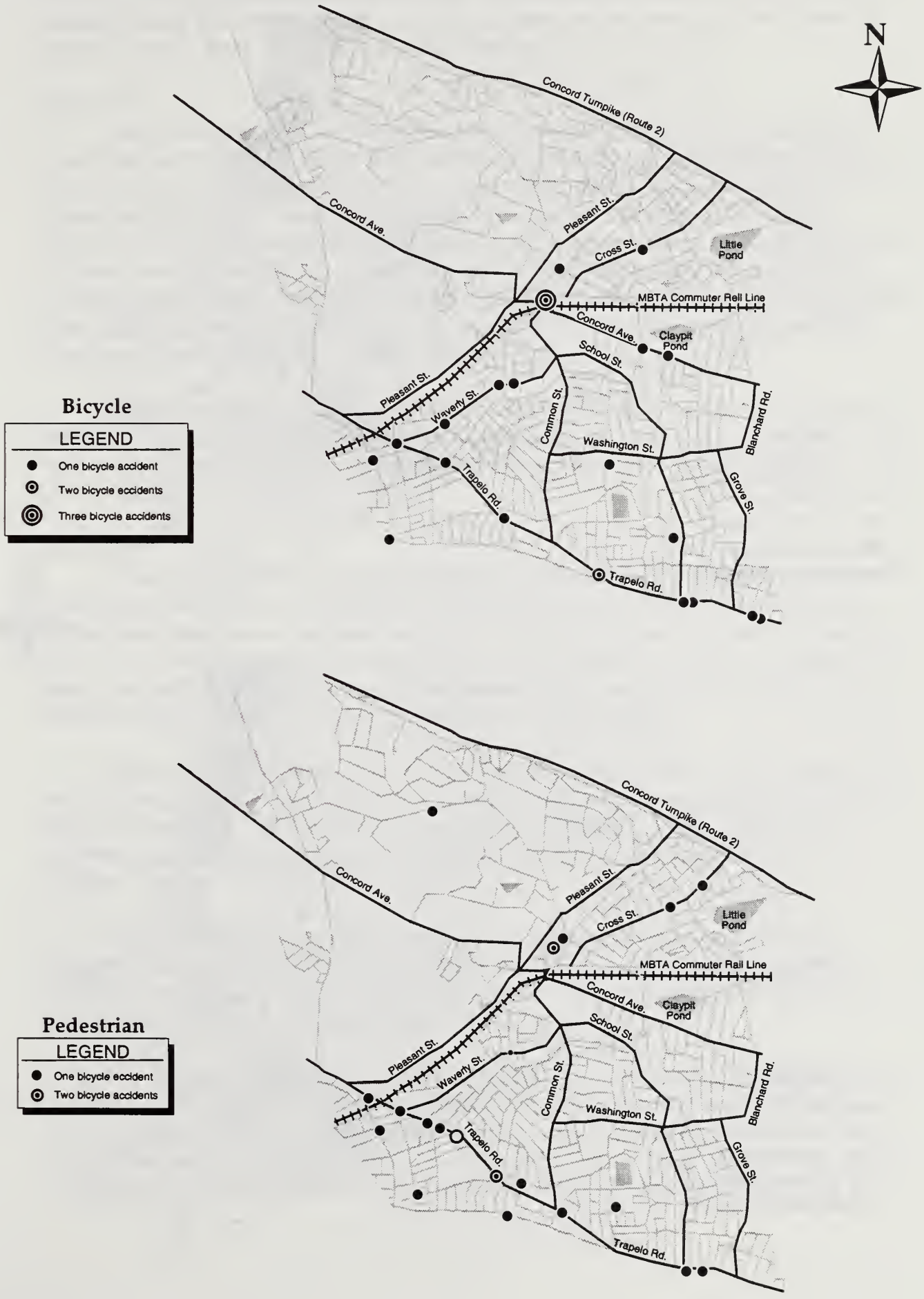
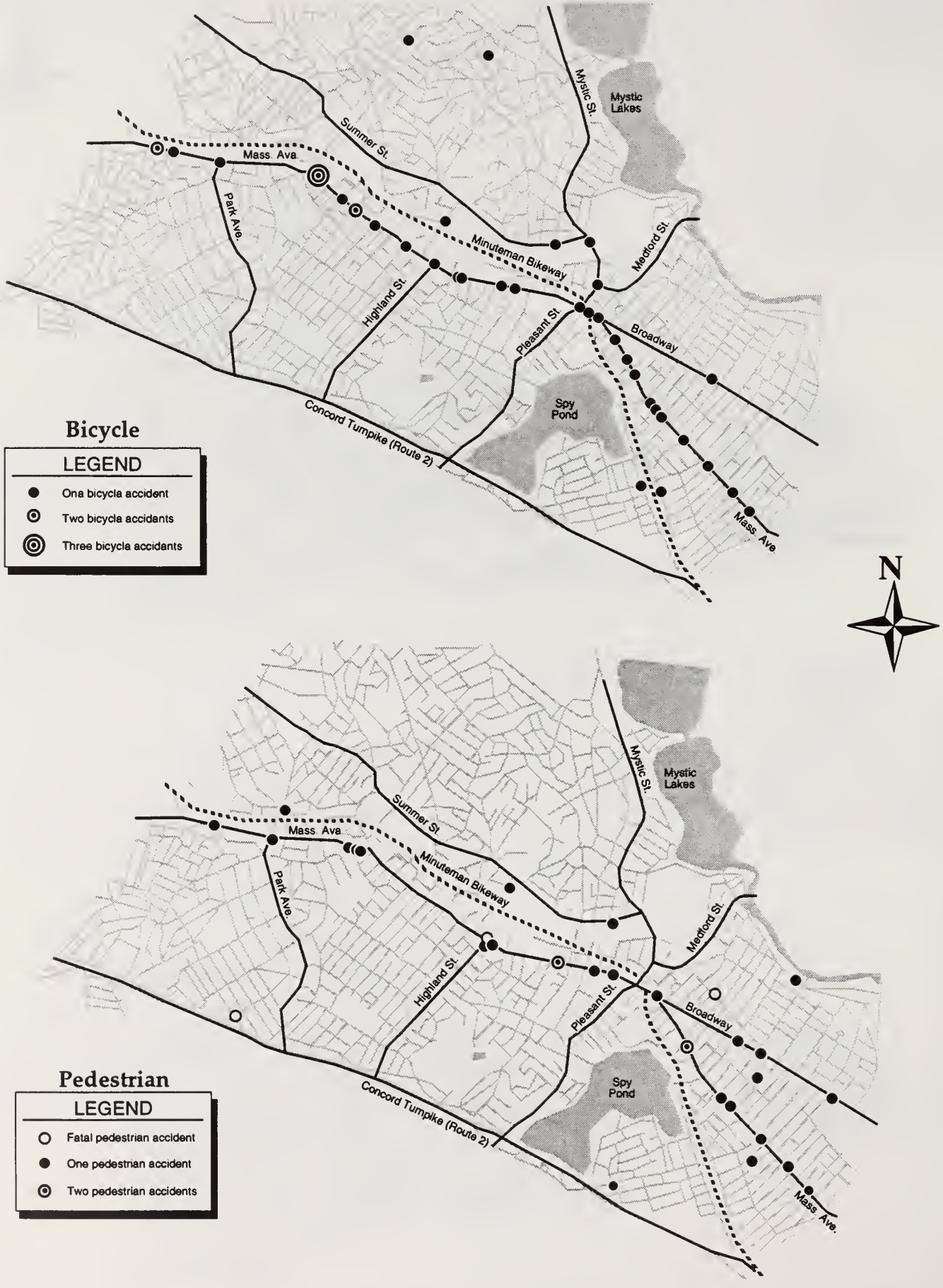


FIGURE 4
Bicycle and Pedestrian Accidents with Automobiles, Town of Arlington, as Reported for the Years 1989, 1990, & 1991



before the Minuteman Bikeway was built. The accidents on Massachusetts Avenue occurred along the entire corridor, with more than one recorded at Forest Street (three), Robbins Road (two), and Dundee Road (two).

Somerville

Both pedestrian and bicycle accidents appear fairly scattered over the city of Somerville (see Figure 5), along with some concentrations. In regard to pedestrian accidents, the largest occurrence is at the intersection of Broadway and Cedar streets, where four occurred. Three occurred at Broadway and McGrath and O'Brien Highway, including a fatality. About three out of four pedestrian accidents occurred on major through streets. Many occurred on Broadway (18, including a fatality), Medford Street (eight), Somerville Avenue (eight), Holland-Elm (six), Washington Street (six), and Highland (nine). Many accidents occurred on the relatively short Morrison Avenue (four) and Temple Street (five).

Turning to bicycle accidents, three occurred at the intersection of Washington Street and McGrath and O'Brien Highway. Many also occurred in or close to Union Square (about seven). There were also many along Beacon Street near the Cambridge line.

Cambridge

A very large number of both pedestrian and bicycle accidents occurred in Cambridge (see Figure 6). In regard to pedestrian accidents, Harvard and Central squares had large concentrations (about ten in Harvard Square, another 14 close by; about 20 in Central Square, another seven close by). There were many accidents along Cambridge Street, all along Massachusetts Avenue, on Rindge Avenue, on Concord Avenue, on Broadway, on First Street, and on Brattle.

Significant concentrations of bicycle accidents occurred in Central Square, Harvard Square, and Inman Square, and at River Street at Memorial Drive, Inman Street at Broadway, and Garden Street at Concord Avenue. There were many accidents all along Massachusetts Avenue, Cambridge Street, Broadway, and Western Avenue.

Central Square has the highest concentration of pedestrian and bicycle accidents combined. In Harvard Square, there are more pedestrian than bicycle accidents. For both types of accidents, Cambridge's highest accident corridors are Massachusetts Avenue and Cambridge Street.

It is interesting that in the immediate study area (the Fresh Pond corridor and environs), there are relatively few bicycle accidents compared to other areas in the city. The entire area bounded by Massachusetts Avenue, Walden Street, and Huron Avenue had only one bicycle accident (some occurred directly on these streets where they border this area). The situation is different with pedestrian accidents, with a

FIGURE 5
Bicycle and Pedestrian Accidents with Automobiles, City of Somerville, as Reported for the Years 1989, 1990, & 1991

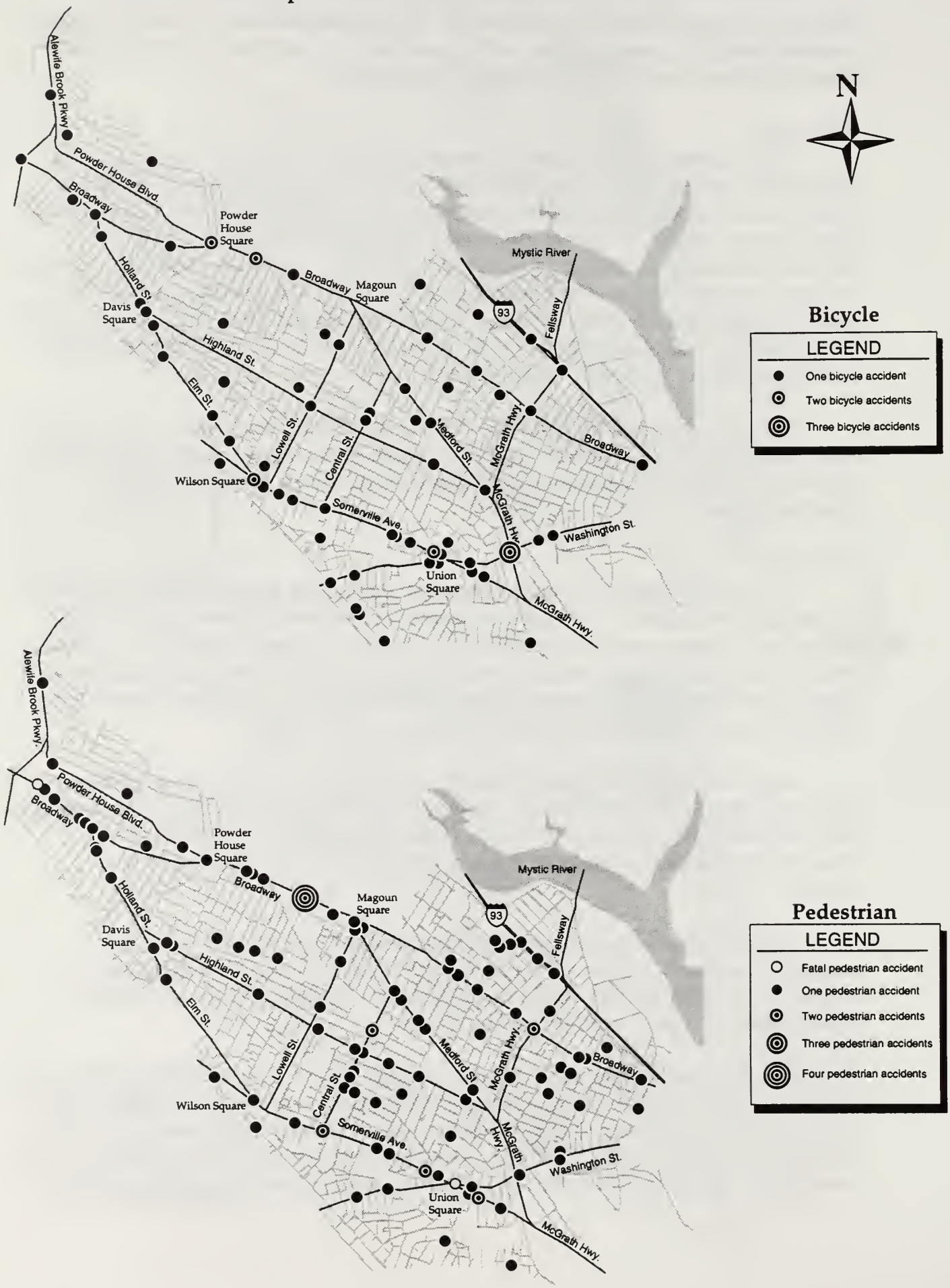
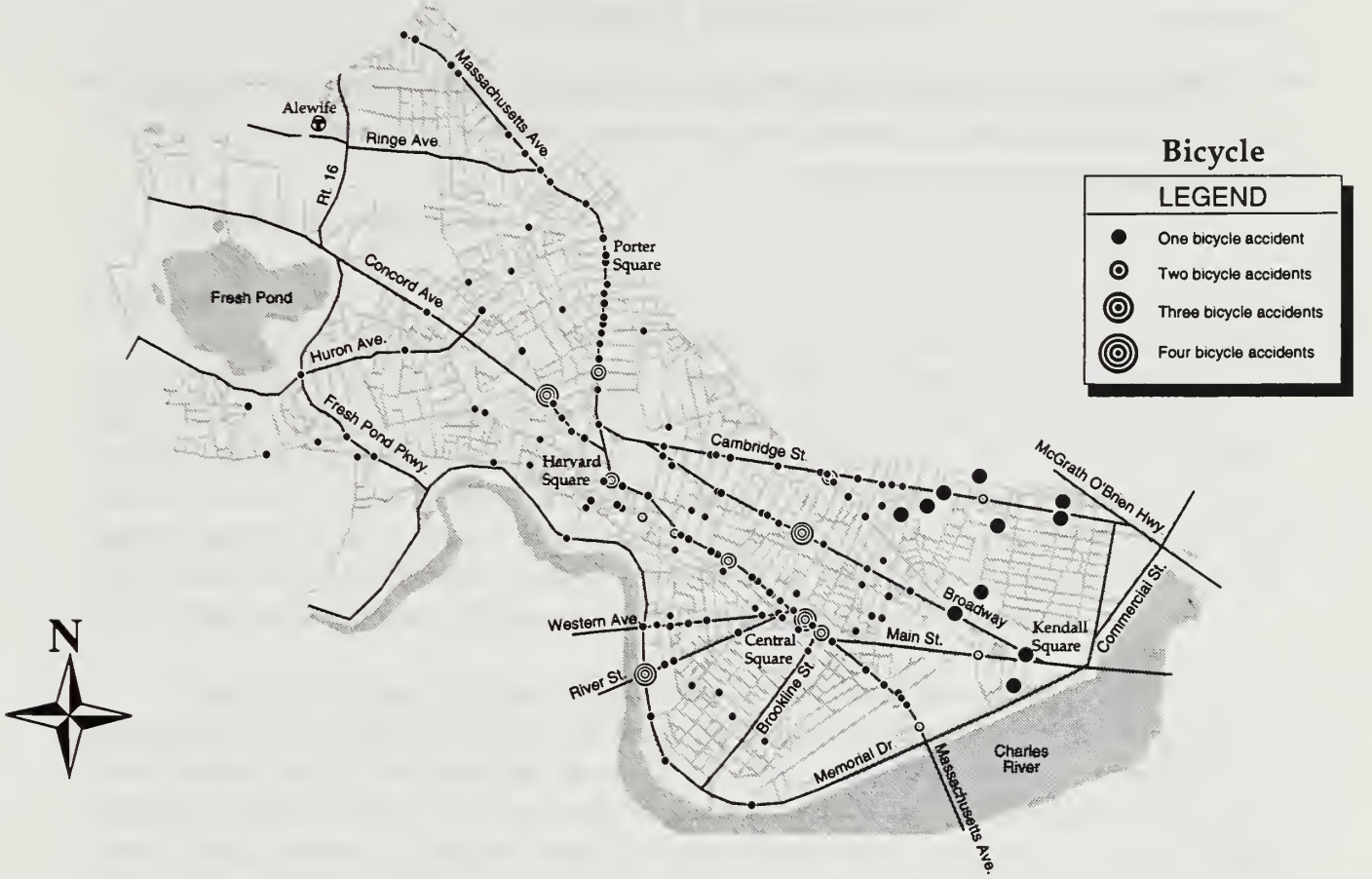


FIGURE 6
Bicycle and Pedestrian Accidents with Automobiles, the City of Cambridge, as Reported for the Years 1989, 1990, & 1991



large number occurring on and near Rindge Avenue, and many others on Concord Avenue.

The lack of accidents along Concord Avenue near the reservoir and along Alewife Brook and Fresh Pond parkways is most likely due to very low levels of walking and bicycling in this area.

2 On-Road Alternatives

A. Existing Connections

Bicyclists

Present connections between the Minuteman path and the Charles River are via the existing road system. The most direct route, a distance of just over two miles, is a formidable challenge even to the most experienced cyclists: Alewife Brook Parkway to Fresh Pond Parkway to the Charles River. This route is difficult because motor-vehicle traffic volumes are heavy, the traffic lanes are narrow, and traffic speeds are high, except at times of severe congestion. Fresh Pond Parkway has four travel lanes and varies in width from 40 to 48 feet. Alewife Brook Parkway is being reconstructed and will have sidewalks and five-foot shoulders.

Going from Alewife Brook Parkway to Fresh Pond Parkway requires negotiating two rotaries at Concord Avenue, the one closer to Alewife being the more demanding when heading towards the river. Another difficult crossing is located between Fresh Pond Parkway and the Charles River: although traffic lights permit this crossing, bicyclists need to merge across high volumes of motor-vehicle traffic to reach that signal.

Pedestrians

The most direct connection along the Fresh Pond Parkway is also difficult for pedestrians. There is no traffic light to allow a safe crossing of Concord Avenue anywhere in the Fresh Pond area. The closest signal is at Moulton Street, a distance of over 400 yards from Alewife Brook Parkway. In the other direction, the nearest signalized crossing on Concord Avenue is at Walden Street, a distance of 0.6 mile. Given the traffic volumes and speeds in this corridor, Concord Avenue is a barrier. It separates the Fresh Pond Reservoir recreational area from Alewife Station and the Fresh Pond Shopping Center. Those without access to a motor vehicle are essentially cut off from the other side.

Except for this barrier, pedestrians have many alternatives to get from the Alewife area to the Charles. The quickest is by riding the MBTA's Red Line. All trail users except bicyclists may access the Red Line during all of its operating hours. Those interested in walking between the Minuteman and the river have many alternatives in Cambridge that are primarily low-trafficked streets with sidewalks. The area is built-up, primarily residential, and many of the alternative routes are quiet and pleasant. The most direct route (Alewife Brook and Fresh Pond parkways)

does have sidewalks much of the way, although these are in need of repair. This route is generally unpleasant because of the proximity of large volumes of motor vehicles with their concomitant noise and fumes. Concord Avenue from the rotary at Fresh Pond to Lakeview Avenue, across from the reservoir, is commercial, with cars coming in and out of intersecting driveways and roads. There are no sidewalks. The reservation side has an attractive trail that is cut off from the Fresh Pond Shopping Center and Alewife due to the aforementioned Concord Avenue barrier.

With the completion of the new Alewife bridge (Route 2 over the railroad tracks), access from the station area to the shopping center will be improved. Reaching Danehy Park still will be difficult, as there is no designated route through the parking lot. Once Danehy Park is reached, there are good pedestrian connections through the Cambridge neighborhoods to the river, although with the same difficulties of crossing Memorial Drive as have been mentioned.

B. Street-by-Street Suitability Ratings for Bicycling

Although there are many alternative bicycle routes available, it became apparent after considerable searching that no one alternative was emerging as the best connection between the Minuteman Path and the Charles River. It was determined that a street-by-street rating might help. The following criteria were used to perform this rating:

- One or two-way traffic
- Parking (one or both sides of street)
- Lane width
- Intersections
  - frequency
  - traffic control
  - sight distance
- Driveways
  - frequency
  - sight distance
- Pavement condition
- Commercial activity
- Aesthetics
- Terrain
- Distance between required stops

This type of suitability rating has been used extensively throughout the country; it has been used successfully most recently in the Boston MetroWest area. A MetroWest road suitability map for bicyclists was published in 1996.[1]

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[1] This map was part of the *MetroWest Bicycle-Pedestrian Study*, published by CTPS in October 1996.

While a list of criteria is important, it is the relative weight applied to each criterion that determines the overall outcome. The roads were actually rated twice, once by the list of criteria and again by a "common sense" analysis. The results of the suitability analysis are shown in Figure 7.

It became clear that width is a major factor in determining the acceptability of a road for bicycling. Width is directly related to other listed criteria, such as parked vehicles, one-way or two-way traffic, sight distance, etc. That is, if there is enough room for bicycles and cars to travel together, then the fact that there are cars parked on the road is not so important. There will be room for bicycles to go by without being so near as to be hit by a car door opening. Likewise, the sight distance at a driveway is much more of an issue when a bicycle has to travel close to parked cars and has little time to react to a car pulling out.

C. Alternative On-Road Routes for Bicyclists

The alternative routes from the Alewife area to the river can be broken into easterly and westerly, those that go east or west of Fresh Pond Reservoir. The most direct routes are to the east.

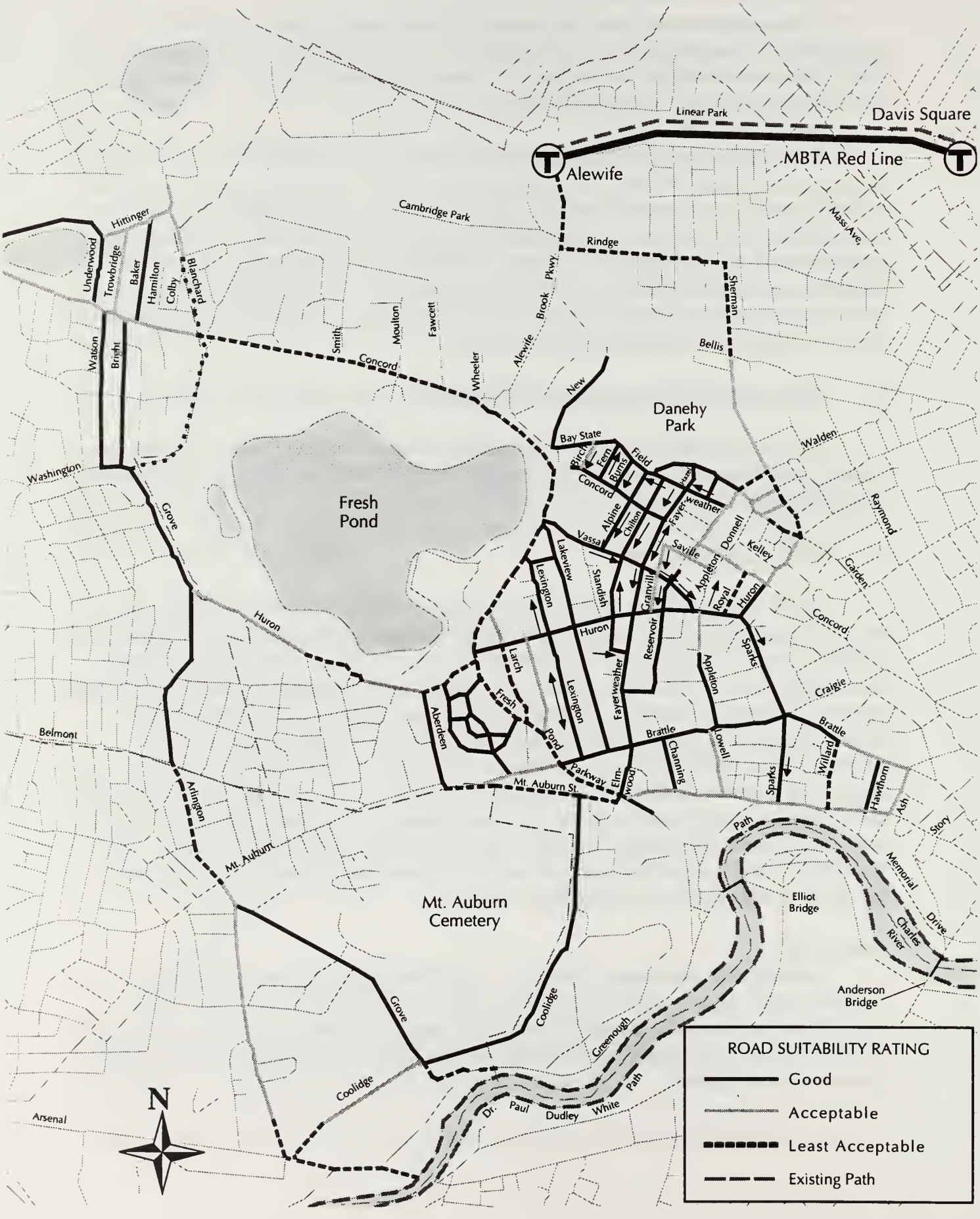
1. *Easterly Alternatives*

There are three main ways to proceed from Alewife on the east side. One is via the Linear Park, the second is through the shopping center to Danehy Park, and the third is out Alewife Brook Parkway to Concord Avenue. (It is also possible to use Rindge Avenue, crossing at the traffic signal on Alewife Brook Parkway. Rindge Avenue, however, is narrow and busy, with many driveways and commercial activities, and less attractive than other alternatives.) Whether the Concord Avenue barrier will be eliminated affects which alternatives would be selected. (An additional possible connection would be from Russell Field, across Rindge Avenue, to a proposed pedestrian overpass over the railroad right-of-way into Danehy Park. There have been six fatalities involving people crossing the railroad in this area. The City of Cambridge has been interested for some time in getting an overpass in this area to eliminate this hazardous situation.)

Linear Park

Leaving the Minuteman via the Linear Park means continuing through the Alewife MBTA station and crossing under Alewife Brook Parkway. This leads directly to the Linear Park, which crosses Massachusetts Avenue and then proceeds to Davis Square. The park was recently extended about one-half mile east of Davis Square to Cedar Street.

FIGURE 7
Suitability Ratings of Roads in Study Area



There are many alternatives bicyclists could follow from the Linear Park. They could take Massachusetts Avenue to Harvard Square and the river, or leave Massachusetts Avenue in Porter Square, take Somerville Avenue to Beacon to Hampshire, and reach the river in the vicinity of Kendall Square. These alternatives go through very congested areas and are more appropriate for very experienced cyclists. Bicyclists could also leave the Linear Park before Massachusetts Avenue and follow local Cambridge streets to reach Sherman Street, which is also fairly narrow and not desirable for less experienced cyclists. The Linear Park is best used for access to Porter and Davis squares and other neighboring areas of Cambridge and Somerville. For most users, it is not a good alternative to reach the river.

Danehy Park

The new Alewife Bridge provides access to the shopping center. Bicyclists may proceed southbound on Alewife Brook Parkway, go over the bridge, and then turn right and use a new underpass to reach the shopping center. Cyclists must then negotiate the shopping center parking lot to reach New Street, which leads to Danehy Park. There are bicycle paths in the park which lead to various streets in Cambridge.

There are a myriad of alternatives from Danehy Park to the river. As can be seen in Figure 7, many of the local Cambridge streets going south from Danehy Park are good for bicycling. The one-way patterns in the area discourage through traffic, thereby minimizing motor vehicles using these streets to bypass the congested Fresh Pond-Alewife Brook corridor. These one-way patterns would require one of two things. First, a bicycle route through this area could zigzag to stay in the right direction, with the return route being a different one. The second method would be to allow bicycles to travel two-way on roads that allow only one-way motor-vehicle traffic.

Both of these methods have drawbacks. Realistically, many cyclists will not zigzag but will go straight, going the wrong way on one-way roads. Also, the more difficult a route is to follow, the less effective it is. A missing sign could result in many cyclists getting lost. The main perceived problem with two-way bicycle travel on a one-way road is the possibility of motorists forgetting the "wrong-way" cyclists and turning into the road as if no traffic could be coming from the wrong direction. The combination of unwary motorists and cyclists not taking extreme caution could result in increased accidents.

Going from Danehy Park to the river, the most straightforward alternative is Hazel Street to Fayerweather. Fayerweather leads to Elmwood and the sidewalk along Fresh Pond Parkway to the river. Improvements are necessary to make this sidewalk more suitable for bicyclists. For the return trip, Fayerweather is the wrong

way on two blocks: (1) between Huron Avenue and Vassal Lane and (2) between Concord Avenue and Hazel Street. Another way to deal with these one-way blocks would be to eliminate through motor-vehicle traffic altogether. This was the case on Elmwood Avenue until recently (it is now one-way toward the river). Elmwood was blocked at the Fresh Pond end, allowing only bicycles and pedestrians to pass through. Two-way motor-vehicle traffic was allowed, but could only enter and egress via Brattle Street.

This type of treatment has advantages and disadvantages for residents of the street segments involved. The main advantage is a reduction in motor-vehicle traffic, as only those would enter who have business on the street. The major disadvantage would be that residents would have only one way to enter and exit. Also, adjacent streets might experience increased traffic and those living on adjacent streets would also have one of their driving options eliminated. This type of treatment would also decrease traffic on some nearby roadway segments that lead to and from the blocked segments. These affected segments may be part of the same street, before and after the blocked segments, or on perpendicular segments, leading to and from the blocked segments.

Two members of the Cambridge Bicycle Committee suggested a route from Alewife to Danehy Park to Garden Street to Harvard Square, ending up on the river at JFK Street. It is somewhat complicated, and not suitable for inexperienced cyclists. Many experienced bicyclists, however, would likely prefer a faster, more direct route. It would be preferred most likely by experienced bicyclists heading toward Harvard Square rather than the river.

Concord Avenue

The third and final series of easterly routes requires crossing Concord Avenue. With a crossing in the vicinity of the two rotaries, bicyclists could use the path around the reservoir, use the sidewalk on Fresh Pond Parkway, which would have to be improved, and cross at the Huron Avenue signal to the Huron Avenue bicycle lanes. The lanes end at Sparks Street, which takes bicyclists across Brattle Street to Mount Auburn Street. Variations on this route include going from Huron to Mount Auburn on Lexington Avenue or Lakeview Avenue or Fayerweather Street. Getting from Mount Auburn Street to the river paths will be discussed below.

There are good potential routes north of Huron Avenue that would require a second new traffic crossing. Examples are Lakeview Avenue, Lexington Avenue and Vassal Lane. (Lexington Avenue and Vassal Lane are one-way.) Bicyclists would have to cross Concord Avenue to the reservoir and then cross Fresh Pond Parkway to reach these routes. Although Lakeview Avenue would be about one-third of a mile shorter than the reservoir path-Huron Avenue alternative, the cost of an additional parkway crossing would be substantial. On the other hand,

residents due east of the reservoir would still be cut off from that recreational area even with a signal at one of the Concord Avenue rotaries. Further analysis is required to see where traffic crossings would be best placed in this Concord Avenue-Fresh Pond Parkway corridor, in terms of usage, cost, and effect on motor-vehicle traffic flow. The city of Cambridge, in agreement with the MDC, has hired a consultant team to study these issues in more detail.

2. *Westerly Alternatives*

The west-side routes are useful not only for Minuteman users wanting to reach the Watertown area of the Charles, but also for Belmont and Watertown bicyclists interested in reaching the Alewife area or the Minuteman.

Unless the Belmont right-of-way becomes a path (discussed in next chapter), the only way to go west at this time is to use Concord Avenue. Given the volume and speed of motor-vehicle traffic, as well as the limited width of the road, this is an undesirable alternative. If the path is constructed, there are several ways to go to the river. The path would connect from Alewife Station to Brighton Street in Belmont (becomes Blanchard Road in Cambridge), which is fairly narrow and busy, but cyclists could use side streets (Underwood or Baker Streets in Belmont) to reach Concord Avenue and ultimately Grove Street in Belmont (via Watson Street).

Grove Street between Washington and Belmont Streets is over forty-feet wide and is quite acceptable for bicycling. This brings bicyclists to Belmont Street, and from here there are limited connections to the river. Bicyclists can go straight onto Arlington Street, which is narrow and has heavy traffic volumes, to reach Mount Auburn Street. Beyond Mount Auburn, Grove Street is acceptable until the Arsenal Street area, where it becomes more congested. Also, Arsenal Street itself is very busy, with a particularly difficult intersection at Charles River Road.

Bicyclists could bear left just past the Mount Auburn intersection, staying on Grove Street which leads directly to Greenough Boulevard, which parallels the river. A major problem is the last segment of Grove Street, after Coolidge Street; it is narrow (23 feet), windy, very hilly (downhill toward the river), and has high traffic volumes. Also, there is no traffic signal at Greenough Boulevard to get to the river side. Bicyclists could turn right and go to the Arsenal Street signal, but there is no provision for bicyclists on the west side of Greenough Boulevard from Grove Street to Arsenal Street.

Starting back at Grove Street at Belmont Street, bicyclists could go left on Belmont Street. Belmont Street is narrow with four travel lanes and parking on both sides. The traffic volumes are moderate enough to allow safe passing of bicyclists. Belmont Street then connects to Mount Auburn, where the traffic is

heavier, and cars are often switching lanes to avoid cars turning left into the Star Market lot and Aberdeen Avenue.

Bicyclists could also leave Grove Street before reaching Belmont Street by turning left onto Huron Avenue, which leads to Fresh Pond Parkway. This is essentially a one-and-a-half mile detour to avoid the Concord Avenue rotaries and the narrow section of Fresh Pond Parkway from Concord Avenue to Huron Avenue. Fresh Pond Parkway from Huron Avenue to the river is just as undesirable.

Once on Huron Avenue, one could turn right at Aberdeen Avenue and left onto Mount Auburn Street to Fresh Pond Parkway. Aberdeen Avenue itself is a very good, wide road; Mount Auburn between Aberdeen and Coolidge is narrow and has high traffic volumes. There is a fairly wide sidewalk on the south side, adjacent to the Mount Auburn Cemetery; there is very little room on the road for bicycles. Bicyclists could turn right onto Coolidge Street, which is ideal: wide, low-trafficked, mostly scenic, few intersections. This leads to Arsenal Street, which is very congested and narrow.

Once on Huron Avenue, instead of turning at Aberdeen Avenue, one can go east a little further and use the bicycle lanes to reach local Cambridge roads. (These routes were discussed in the previous section.)

3. *Memorial Drive Crossings*

Similar concerns as found in the Concord Avenue/Fresh Pond area regarding access also pertain to the Memorial Drive area between JFK Street and Fresh Pond Parkway. There is a traffic signal at Memorial Drive and JFK Street with a pedestrian phase. There is a more complicated crossing at Memorial Drive and Fresh Pond Parkway that allows a pedestrian crossing in stages. Those on the west side of Fresh Pond Parkway may (1) cross the first southbound lanes (coming from Fresh Pond Parkway) during one phase, then (2) cross the other southbound lanes (coming from Memorial Drive) during another phase, then (3) cross one set of northbound lanes leading to Fresh Pond Parkway and finally (4) get across northbound lanes leading to Memorial Drive. This crossing is a difficult, time-consuming event.

Given the distance from JFK Street (about three-quarters of a mile) and requirements for motor-vehicle-traffic flow at the Memorial Drive-Fresh Pond intersection, it might be better to add another crossing than to try to improve this one. Potential locations are near Sparks Street, which is about halfway between the two present crossings, and at Hawthorn Street, which is a natural crossing point now. That is, many bicyclists and pedestrians now cross there because breaks in traffic are created by the signal at JFK Street. An advantage of the Hawthorn crossing

is the traffic light at Hawthorn and Mount Auburn, which allows safe access back to or across Mount Auburn Street.

Traffic analysis needs to be done to determine the impact a traffic signal in this area of Memorial Drive would have and how it could be designed so to minimize motor-vehicle delays. These potential traffic delays need to be assessed in the light of the benefits of increased access to the river paths and increased safety for path users.

3 Off-Road Alternatives

There are several off-road alternatives that have been studied as possible connections between the Minuteman and Dr. Paul Dudley White bicycle paths. These are the Watertown Branch, the Alewife-Mystic connection, the Belmont Branch, and the Somerville alternative (see Figure 8).

A. Watertown Branch

The most direct connection to the river on a separate right-of-way would be along the Watertown Branch, which goes from behind the shopping center at Fresh Pond to the vicinity of the Arsenal Mall. The right-of-way is owned by the Boston & Maine Railroad, which operates very infrequent freight service on it and has indicated an interest in abandoning the line. At the present time, abandonment is being pursued. The major freight user is seeking ways to maintain service.

This right-of-way has four grade-separated crossings: (1) at Kingsley Park (the entrance to the Fresh Pond Reservation parking area), (2) under Huron Avenue (near Aberdeen), (3) under Mount Auburn Street (near the Star market), and (4) at Grove Street in Watertown. The major at-grade crossing is at Concord Avenue in Cambridge, between the two rotaries. The other at-grade crossings are at Arlington Street near Nichols Avenue, and farther into Watertown at School Street.

Joint rail and trail use is being discussed. The standard width for joint use is 35 feet, assuming a 12 foot path. This includes 8.5 feet from the centerline of the track to an obstruction on either side, or 17 feet for the track and clearances. The requirement for clearance from the path is two feet for a non-vertical edge and three feet for a vertical obstruction. Three foot clearances are assumed for both the bridge abutment and rail sides, as a fence will undoubtedly separate the two uses. The total is therefore 12 feet for the path, six feet for path clearances, and 17 feet for the track and clearances. To accommodate joint rail and trail use, the track would need to be moved over to afford as much room as possible for the trail.

The bridge cross-sections are indicated in Figure 9. Adding five feet and two inches for the track itself yields the total width of the abutment. Given that 35 feet is required for a 12 foot path, if all clearance standards are maintained, the following would be the width available for a trail under a joint rail and trail scenario:

FIGURE 8
Off-Road Alternatives

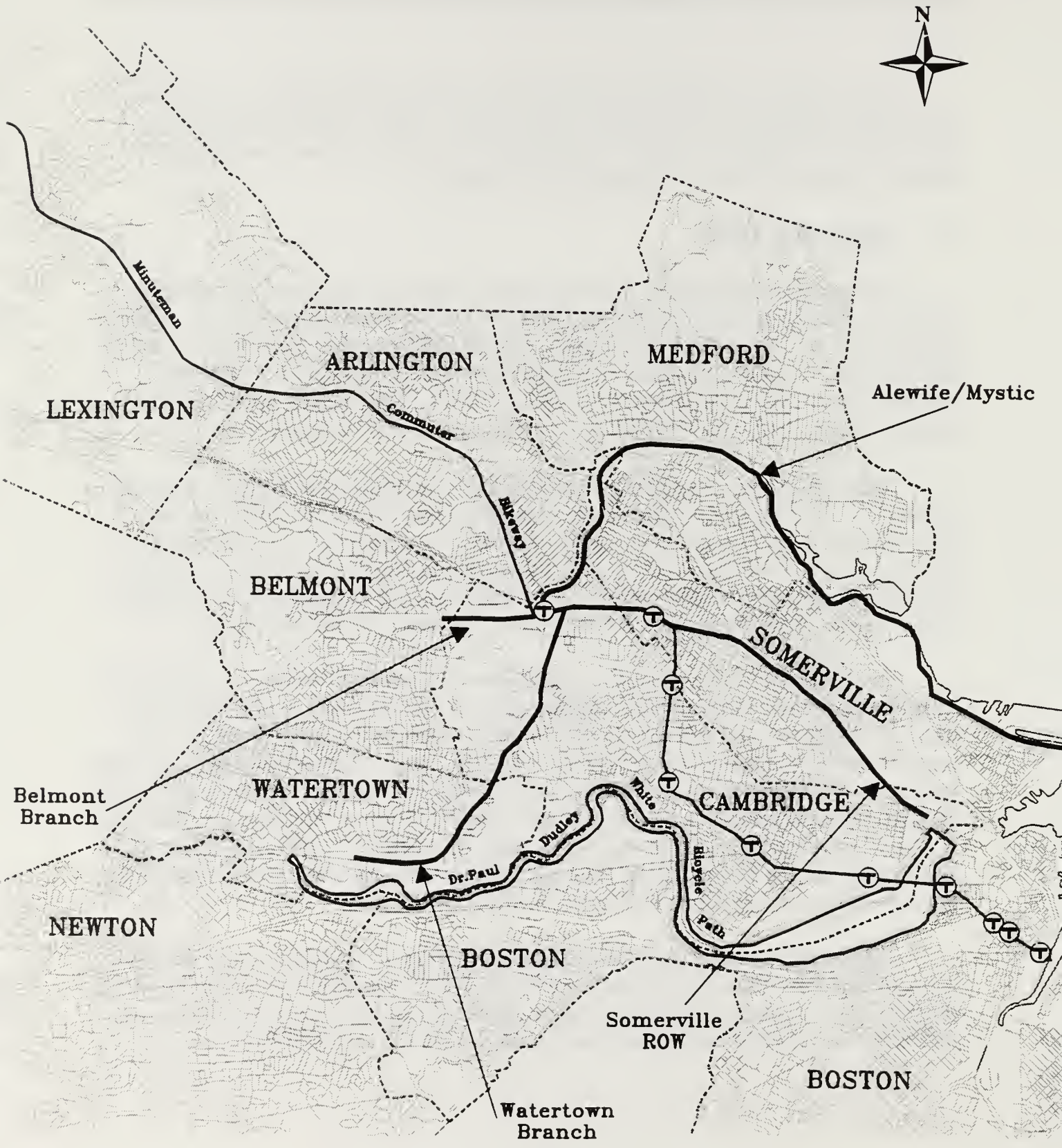
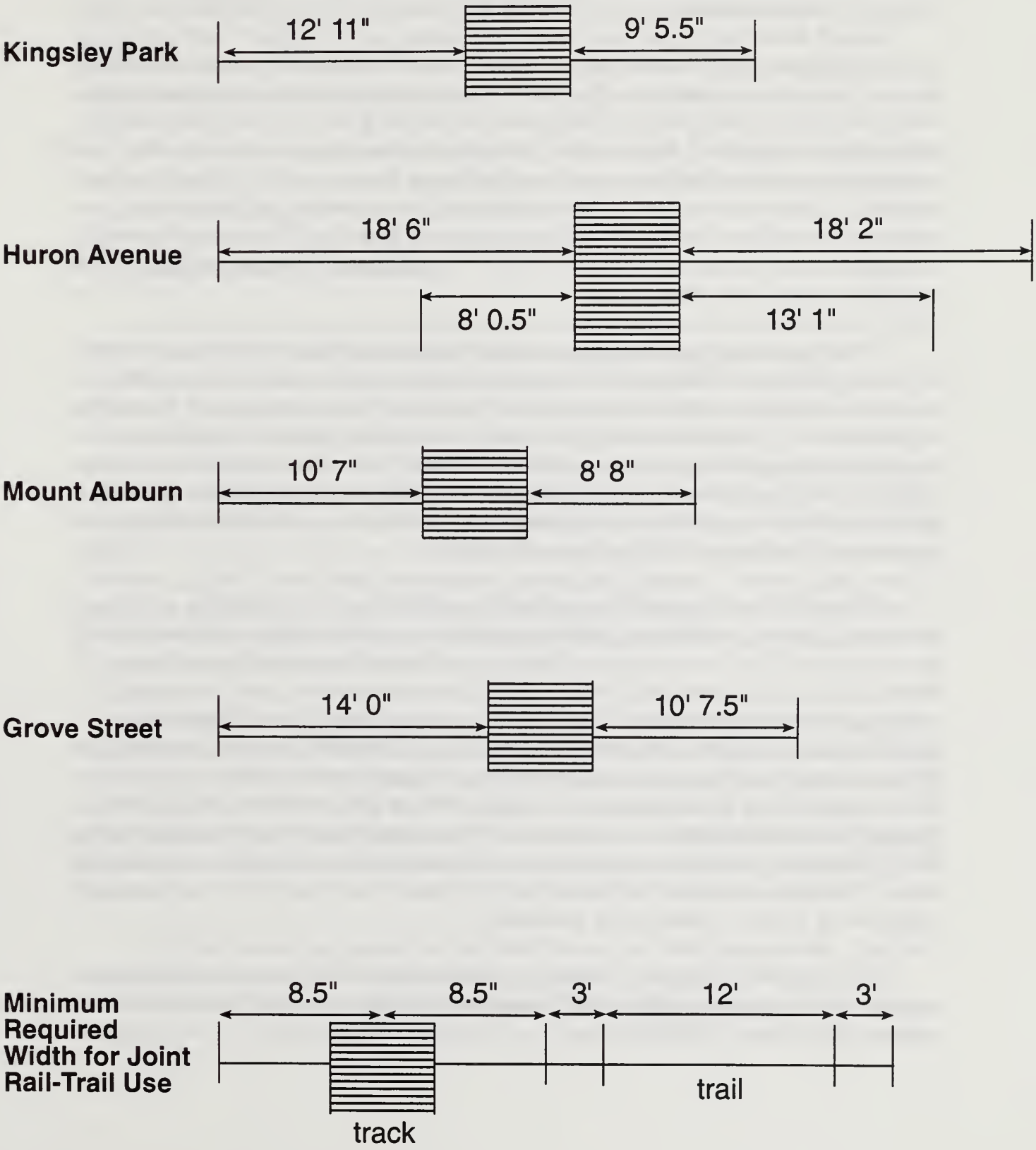


FIGURE 9
Watertown Branch Bridge Dimensions and
Cross Section Indicating Minimum Required Width for Joint Rail-Trail



	Width of abutment	Available width
Kingsley Park	27' 6.5"	4' 6.5"
Huron Avenue	26' 3.5"	3' 3.5"
Mount Auburn Street	24' 5"	1' 5"
Grove Street	29' 9.5"	6' 9.5"

The widest bridge abutment, at Grove Street, would allow a seven-foot trail. None of the others is wide enough for even a five-foot trail. It has been suggested that a trail could avoid the first bridge and use existing or improved paths within Cambridge's Fresh Pond Reservation. It further has been suggested that a trail could be raised upon the sloped abutment under Huron Avenue, making joint use there possible. (There are two sets of dimensions for Huron Avenue in Figure 9 to indicate the widths of the lower and upper sides of that sloped concrete abutment.) If freight use on the line is abandoned before Grove Street, then that bridge might be available for trail use only.

This scenario leaves the Mount Auburn bridge, which is also the narrowest, as the only obstacle. The only way to get more space for the trail in a joint-use scenario is to relax some or all of the width and clearance requirements. Given the infrequency of rail use, and if only one bridge at Mount Auburn is involved, consideration might be given to a protected crossing, where users are kept off the trail while a train passes, as occurs at at-grade railroad crossings of roads. Further study as well as negotiations among interested parties are required to determine the parameters for joint rail and trail use of the line.

If the line is abandoned, the railroad would be likely to sell it. For a trail to be developed, the line would need to be purchased by a public entity or leased from a private party. The former is more likely, especially for the section up to Grove Street, as it is a narrow right-of-way in a cut, has many abutters, and is essentially unavailable for development. The section within the Fresh Pond Reservation could not be developed. The section beyond Grove Street to Arsenal Street has two primary abutters, who are the only ones likely to consider the purchase, as the line itself is too narrow for development (width varies in this area from 30 to 65 feet). Beyond School Street, there are businesses which would like to use the right-of-way for a distributor street to eliminate the need to use residential streets on their north side. The minimum width of this section is 38 feet, which should be sufficient for inclusion of a trail or lanes and a sidewalk.

The cost of acquisition remains to be determined. There is no evidence to suggest unusual construction costs. Assuming $250,000 per mile, the construction cost would be about $625,000 dollars.

Given the directness of the route and the relatively high population densities nearby, it is anticipated that use of a Watertown Branch trail might be comparable to volumes on the Charles River and Minuteman paths. The trail would be very desirable for recreational users. Its use for commuting would include those going to jobs in the Alewife area from Watertown, Brighton, and Newton, for example. It is likely there would be fewer commuting on the Watertown Branch than commute on the Dr. Paul Dudley White paths, which serve the large downtown Boston market, or on the Minuteman, where there is a combination of those going directly to work and those parking at Alewife and taking the T to work.

The Watertown trail is less scenic than either of the paths it would link. The section through the reservoir is the most scenic; the next sections abut residential and then increasingly commercial land uses.

B. Alewife-Mystic Connection

Another, much more circuitous route to the Charles would follow the MDC's Alewife and Mystic reservations, installing and upgrading a path along those parkways. A wooden bridge would be installed somewhere over Alewife Brook. A signalized pedestrian crossing near W.R. Grace would be considered, allowing better access to Alewife. Along the parkway, the existing sidewalk would be widened to serve as a multi-use trail. The Henderson Bridge could be closed to vehicular traffic, depending on neighborhood feelings. A pedestrian bridge near the Dilboy facilities would provide area connections. A path connection could then be made under the tunnel on a wooden bridge on piles, underneath the arch to avoid conflicts with the parkway. A path could then be extended to Medford Square. Further links would need to be explored. One possibility is to link up with the proposed "Bike to the Sea" trail in the vicinity of the Amelia Earhart Dam, thereby connecting the Minuteman to the Atlantic Ocean.

The MDC is interested in pursuing this Mystic/Alewife alternative and will release a report this fall describing improvements planned for the corridor. During this study, an MDC survey indicated extensive encroachments along portions of the Alewife-Mystic corridor. The MDC anticipates that while some time will be required to deal with these land issues, they are not seen as significantly impeding progress on the project. It is possible that preliminary engineering and design could begin soon.

The trail would be located on parkland, in and of itself quite scenic. The trail would often be adjacent to high-volume, high-speed arterials, however, which would reduce its attractiveness in those areas. There also would need to be careful thought given to designing the intersections.

With some bridge treatments and possible signals, a very preliminary estimate for construction is one million dollars.

Use of the path would be expected to be relatively high, given population densities and the path's providing a convenient, safe connection to the Minuteman, though use is not likely to be as high as on the Minuteman or Charles River paths.

C. **Belmont Branch**

On the western side, there is a potential trail that parallels the portion of Concord Avenue from Fresh Pond Parkway to Brighton Street in Belmont. It is immediately adjacent to (and separated by a chain-link fence from) the railroad right-of-way used by freight and by commuter trains to Fitchburg. The major portion of this trail is now quite usable for pedestrians and wide-tire bicycles. Both ends of the trail, however, at Alewife Station and at Brighton Street, are obscure and overgrown and difficult both to find and to negotiate. It is essentially blocked at the Brighton Street end. (Blanchard Road in Cambridge becomes Brighton Street in Belmont. Most of the right-of-way is in Cambridge.)

This right-of-way is now owned by the MDC, having been obtained from the MBTA during the Alewife Station construction project. The MDC is supportive of having trail improvements made in this area. The MBTA is supportive of improving the connection to Alewife Station. This right-of-way is included in an MHD design-construction contract which began in late summer 1995. This MDC right-of-way is adjacent to the Alewife Reservation.

Connections to the river from the terminus of this trail at Brighton Street need to be made on the road system. There are alternative routes that are acceptable for the most part, with sections that are too narrow for comfortable bicycle-motor-vehicle sharing, given the traffic volumes and speeds. It is unlikely that cyclists wishing to reach the river in the Cambridge area would use this Belmont spur. It would be most useful for those trying to reach Alewife and the Minuteman from Belmont and Cambridge neighborhoods west of Alewife.

The town of Belmont is interested in pursuing a trail beyond Brighton Street into Belmont Center. That segment is now privately owned. There is also the possibility of eventually connecting to the Central Mass. Branch in Waltham. A feasibility study for trail conversion of that right-of-way began in mid-1996.

As has been stated, this is more a connection to Alewife and the Minuteman trail for those west of the station than it is an off-road connection to the river. Assuming no significant wetland issues, the construction cost of this three-quarters-of-a-mile path is likely to be on the order of $200,000. The cost could be higher,

depending on the type of bridge that is constructed to link this path to the Alewife Station area.

D. Somerville Right-of-Way

An alternative that has been promoted by members of the Somerville Bicycle Committee is a trail that would be constructed beyond the present terminus of the Linear Park at Cedar Street. This alternative would be contained within a very active rail right-of-way (both freight and commuter rail service). The trail could ultimately go as far as the Charlestown Navy Yard. Preliminary study suggests that there is probably room for a trail in this corridor, although future rail uses might prevent it. It would be a tremendous asset to Somerville, given the paucity of open-space alternatives in that city, and serve the region as well by connecting the Minuteman to Charlestown and the Charles River.

The extent of active service on the right-of-way is a definite stumbling block to implementation of this alternative. The possible extension of the Green Line to Tufts University along this right-of-way is another. It would take some active, creative interest on the part of the MBTA, the freight operators, and the community of Somerville to see it happen. The trail would be expected to have very high ridership, based primarily on populations served and on the possibility of reaching the downtown area. A cost estimate is very difficult to make because it is unclear what types of connections might be needed at intersections and whether any tracks would need to be moved. It would be reasonable to assume a minimum cost of two million dollars.

The scenic quality of the right-of-way is not high. There are tracks on one side and residential, commercial, and industrial uses on the other. It would definitely be an urban arterial among trails.

4 Recommendations

The following recommendations are based on analysis of alternatives and some initial input from the community. Two public information meetings were held, as well as eight meetings of the advisory committee and two meetings with staff members from the city of Cambridge.

Coverage and Type of Users

Separate recommendations are made for on-road and off-road projects. The primary factor for ruling out alternatives is safety. There are two issues pertaining to both types of facilities that further guided the selection: (1) geographic coverage and (2) types of users.

What is meant by geographic coverage is where the users of a given path would be coming from and going to. The people who would use these facilities live all over the study area (and beyond) and are traveling to many different locations. No one alternative can satisfy all users.

In terms of types of users, the trip purpose affects the type of facility desired. For example, for commuters and other utilitarian cyclists, time is the issue. These cyclists have a specific destination, the location of which probably dictates more than any other factor which route they take. If an off-road path is available but it takes more time because of path congestion or distance traveled, this type of cyclist might forego it for an on-street route.

Cyclists more interested in going for a pleasant ride than quickly reaching a specific destination are less influenced by time, and therefore distance, and more by scenic quality and separation from motor vehicles. These cyclists are influenced by distance in a different way. That is, they may cycle on a path and then turn around and return when they have gone as far as they wish to. The specific location of the path may be less important.

To satisfy the needs of as many users as possible, it is recommended that an area-wide program begin. The most important part of that program is addressing existing barriers and bottlenecks. At the top of that list are two items: (1) improvements to the existing Charles River (Dr. Paul Dudley White) bicycle path and (2) elimination of the barriers created by the Memorial Drive-Fresh Pond Parkway system.

Charles River Path

The Charles River path was begun over twenty years ago and finished in 1982. It is important that it be brought up to standards as soon as possible. Even without the new connections to the Minuteman that will increase use of the river paths, there is a need to improve conditions for the thousands of existing users. These improvements will be beneficial to all types of users, as the problems for cyclists are also problems for walkers, skaters, and others.

Most of the Charles River path is ten feet wide. Some sections are narrower. There is a particularly difficult section near Cambridge Street and the Massachusetts Turnpike interchange: the path is very narrow, the pavement is a combination of smooth asphalt and bumpy granite, and it is adjacent to guard rails that protrude into the path. The guardrail is so low that if a cyclist hit it, he or she might topple into the travel lanes of Storrow Drive, where motor-vehicle-traffic volumes and speeds are high.

There are locations on the path where horizontal sight distance is limited. The path goes under Storrow Drive abutments, for example, and was built right up to the curving abutment sides, without side clearances, resulting in some blind corners. Some of the crossings of Storrow Drive, including the Fiedler Footbridge, have sections where those entering and exiting the path cannot see each other. This occurs on the winding ramp sections, where traffic heading down the ramps must make a sharp, blind turn. Also, there are crossings with no traffic signals and others where the path users cannot see the traffic lights and therefore do not know who has the right of way.

Fresh Pond Parkway/Memorial Drive

The greatest opportunities in the study area to improve the connections between the Minuteman and the Charles are within the Fresh Pond Parkway/Memorial Drive system. The most important area to address is the connection between the Fresh Pond Reservation and the Fresh Pond shopping area. This part of Cambridge has high-density residential neighborhoods close by. Furthermore, the reservation attracts people from other communities. Likewise, the Fresh Pond shopping area is a regional facility attracting shoppers from a large catchment area. For non-motor-vehicle users, these amenities are separated from each other by the road system.

The city of Cambridge is doing a traffic and preliminary engineering study of the entire Fresh Pond Parkway from the Concord Avenue rotaries to the intersection with Huron Avenue, to determine the best roadway and sidewalk treatments. Ideally, pedestrians would be able to cross safely somewhere in the vicinity of the two Concord Avenue rotaries and again somewhere between these and Huron Avenue. There is also the consideration of a safer crossing for the

freight trains on the Watertown Branch. Presently, B&M personnel must stop the motor-vehicle traffic in order to get the trains across.

An at-grade crossing appears to be the best alternative. Either a bridge or tunnel would take a very large amount of land, given the slope requirements, would be uninviting to many, and would be a much greater expense. The at-grade alternative would impact existing roadway traffic. The effect of this impact needs to be determined. New traffic signals in this area would need to be synchronized with the other signals nearer to Alewife Station; possibly they could be designed to allow some traffic flow during pedestrian phases.

Multi-modal Planning

The entire issue of accessibility for all modes needs to be examined. The point has been made that traffic signals can slow traffic flow, increase congestion, and thereby increase pollution levels. This argument has to be weighed with the need to improve conditions for other modes so that they become more attractive to people who may forsake or reduce auto use in favor of more walking or bicycling.

Another means to improve the connection between the Minuteman and the Charles River would be to increase bicyclists' use of the MBTA's Red Line. The Red Line provides connections to the Charles River path at Kendall Station in Cambridge and at MGH/Charles Station in Boston. Given ridership levels on the Red Line, it is problematic that the present schedule allowing bicycles on the Red Line could be greatly expanded. There is a need for additional, secure parking, including lockers for those who wish to rent them, to facilitate the use of the bicycle as a feeder mode to Alewife and other MBTA stations.

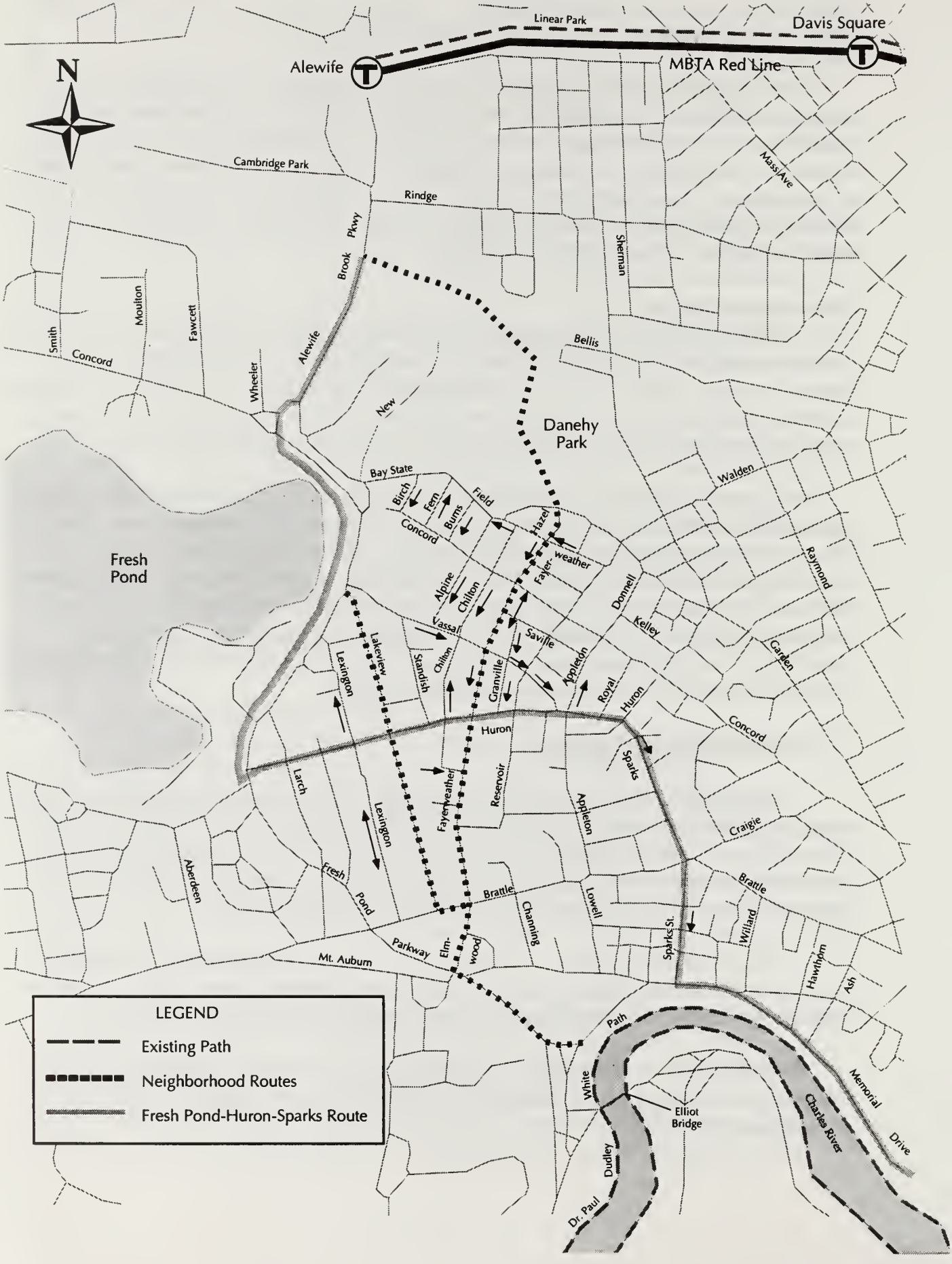
A. Specific On-Road Routes

While area-wide improvements are highly recommended, one or two routes should be provided as principal routes for cyclists going between Alewife and the Charles River. One route that stands out is the Fresh Pond-Huron-Sparks-Mount Auburn alternative. Another alternative would follow more local streets, such as Fayerweather, to reach Mount Auburn Street and then the river.

It is recommended that more than one route be provided. These routes go through different neighborhoods and would serve different users. They also have different qualities, such that some bicyclists might prefer one over the other.

Specific links and treatments for these alternatives are up to the city of Cambridge, as the on-road alternatives are within the city. Recommended routes are indicated in Figure 10.

FIGURE 10
Recommended On-Road Alternatives



1. *Fresh Pond-Huron-Sparks-Mount Auburn*

This alternative is a combination of path, lane, and route. With the completion of the Alewife Parkway construction, a bicyclist will be able to travel from Alewife to Concord Avenue. A consultant study, sponsored by the city of Cambridge and funded by the MHD, is addressing how to cross the Concord Avenue/Fresh Pond corridor and how to get from the Kingsley Park entrance on Fresh Pond Parkway to the parkway's intersection with Huron Avenue. The existing sidewalk is very narrow and needs to be widened.

Once on Huron Avenue, there are bicycle lanes, installed in September 1995, for the entire length to Sparks Street. Sparks Street is a wide, relatively quiet street that takes bicyclists all the way to Mount Auburn Street. Sparks Street is one-way toward the river. An alternative connection to Huron Avenue is necessary to return to Alewife (unless two-way bicycle travel is initiated). It appears that Hawthorn to Brattle and Brattle to Huron Avenue via either Appleton or Fayerweather or Lakeview may be the best alternative.

Between Mount Auburn Street and the river, an alternative would be to designate a new crossing of Memorial Drive at Hawthorn Street (or further west). As discussed above, many cyclists now cross at this point, as there are gaps in the traffic and good sight distance in either direction. The traffic signal could be user-activated, allowing more experienced cyclists to cross when traffic allows rather than stopping the traffic.

In summary, this alternative requires: (1) a crossing of Concord Avenue, (2) improvements within Kingsley Park and along the Fresh Pond Parkway to Huron, (3) a connection from Mount Auburn to Huron (possibly a two-way treatment on Sparks Street), and (4) a new crossing of Memorial Drive or sidewalk improvements to reach JFK Street.

2. *Neighborhood Roads*

A review of Figure 7 indicates that there are many routes that one could follow through the neighborhood streets in the area. A Fayerweather alternative is one of the most direct, being slightly shorter than the Huron-Sparks alternative (2.5 versus 2.8 miles). Some sections of the route are one-way, some two-way. The one-way sections need either to be made two-way for bicyclists or to have substitutes for the reverse trip.

Another method would be to close off one or more blocks of Fayerweather Street to through motor-vehicle traffic. That would be done by allowing automobile access only at one end of the street. The road segment would then be two-way for both motor-vehicle and bicycle traffic, but the motor vehicle traffic would be limited

to those who live there or are visiting there. The effect would be almost total elimination of motor-vehicle traffic on that particular block. This closing off of Fayerweather would also likely have an effect on adjacent blocks leading directly to and from the closed-off section of Fayerweather, making them less desirable routes for all non-local motor traffic. On the other hand, parallel streets could have corresponding increases in motor-vehicle traffic. This might be a more controversial method, even if the traffic increases are minimal on parallel streets, because it is a relatively significant physical change.

There is one section of a block of Fayerweather that is less attractive for bicyclists because there are usually cars parked on both sides of the street, thereby diminishing the effective width of the road. This is the section just south of Huron. Two ways to improve this section are to eliminate parking on one side or to make a block or part of the block one way. Eliminating parking would be very unpopular. Making the block from Huron to Reservoir one-way only for motor vehicles probably would divert some traffic to Reservoir.

Connections to the Fayerweather corridor from the Alewife end would be along the newly constructed Route 16, under that route to the shopping center parking lot, and then along New Street to Danehy Park. Bicyclists could follow paths within the park to Hazel Street, which connects to Fayerweather. Fayerweather connects directly to Elmwood Avenue. From Elmwood, bicyclists could use the sidewalk path, which would need to be improved, to reach a crossing of Memorial Drive, probably at JFK or Hawthorn Street. Bicyclists would then be on the Dr. Paul Dudley White Bicycle Path.

As can be seen in Figure 7, there are many acceptable roads for bicycling in this residential area of Cambridge. Two members of the Cambridge Bicycle Committee, for example, recommended Lakeview Avenue as a good connection to Brattle Street, and from there to Elmwood. Lakeview Avenue is a very good bicycle route. It has the advantage over Fayerweather of a traffic-signal crossing at Huron and the disadvantage of requiring a more circuitous connection on the Alewife side. The main point, however, is that the city of Cambridge staff, working with local committees and neighborhoods, can find a good alternative that will serve both local bicyclists and those trying to connect from the Minuteman to the Charles River paths. Certainly such a route would not attract nearly as many users as a trail would, but it could be very helpful to those using the on-road system.

B. Off-Road Alternatives

It is recommended that all off-road alternatives be pursued as far as possible, as they do not overlap geographically and would serve different purposes, origins, and destinations. Given the density of population in this area and the high use that the existing trails are receiving, there is no doubt that all would attract many users.

The most important initiative is to improve the Dr. Paul Dudley White paths from the Charles River Dam in Boston to Watertown Square. Improvements at the Boston end will occur as part of the Charles River master plan. The MDC is working on extending the path westerly from Watertown Square to Newton in the vicinity of Commonwealth Avenue, thereby increasing the potential market for the present path.

Other than the improvements along the Charles River, the only alternatives ready to go into design and construction are the Belmont Branch and the Alewife-Mystic alternative. It is recommended that these proceed as quickly as possible. These are both in public ownership, the MDC being the owner in both cases. The Belmont Branch is included in the design/construction contract being done under the auspices of the MHD. It is clear that the Alewife-Mystic alternative would not attract many commuters wanting to go from Alewife to downtown Boston, as the trip would be about seven or eight miles from Alewife to the Charles River in the vicinity of Charlestown. The westerly route through Belmont would be about 4.5 miles. These alternatives would serve, however, those commuters who live or work nearby.

The Watertown Branch is the most direct off-road connection to the river (about three miles). Although abandonment may proceed in the future, it is now a privately owned facility serving freight rail and opportunities for joint rail and trail use need to be investigated. If freight use were ever discontinued on the line in the future, then the use of the line as a trail ought to be pursued at that time.

The Somerville Branch is in public ownership. Discussions need to be held with the MBTA and the freight operators to determine whether all or portions of a trail could be built in this corridor. In some sections, a trail might be built on a viaduct within the right-of-way, so that connections to intersecting roads would be easier (where the right-of-way is much lower than the street system). This also might result in less interference with railroad operations.

Not surprisingly, in such a densely populated area, there is no outstanding off-road connection between the Minuteman and the Charles River paths, and there is no one facility that will serve all the myriad trips that bicyclists and other users need and want to make.

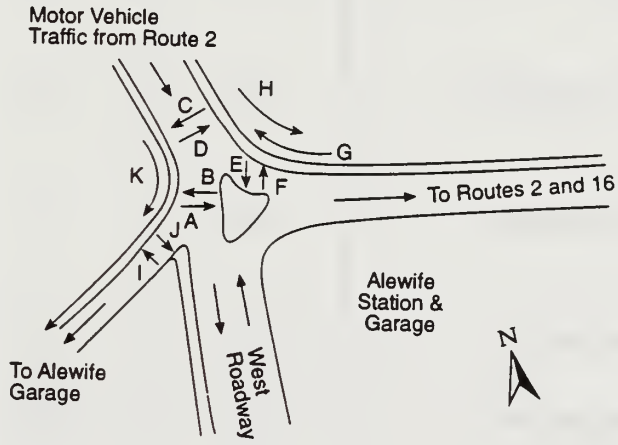
The off-road options that are available, however, will do much to provide access to many bicyclists and other trail users who have no trail opportunities within their communities. And while certain on-road alternatives have been selected, it is important to recognize that all non-express roads are open to bicyclists and that they need to be designed, built, maintained, and reconstructed with those users in mind.

APPENDIX A

TABLE A1
Alewife Station Area
Wednesday, September 15, 1993, 8:00-9:30 AM

Pedestrians

Time	A	B	C	D	E	F	G	H	I	J	K	Total
Starting at:												
8:00	0	6	0	0	54	1	0	3	15	1	0	80
8:15	0	4	0	0	53	3	0	2	8	2	0	72
8:30	4	0	3	1	44	3	0	0	5	2	0	62
8:45	0	2	3	0	29	0	0	0	3	5	0	42
9:00	0	1	0	0	19	1	0	2	0	2	0	25
9:15	2	0	1	0	8	2	1	0	1	7	0	22
Total	**6**	**13**	**7**	**1**	**207**	**10**	**1**	**7**	**32**	**19**	**0**	**303**



Bicyclists

Time	A	B	C	D	E	F	G	H	I	J	K	Total
Starting at:												
8:00	2	1	0	1	6	1	0	10	0	0	0	21
8:15	0	0	0	0	7	0	2	10	0	0	0	19
8:30	0	0	0	1	8	0	3	2	1	1	0	16
8:45	0	1	2	0	7	0	0	6	0	0	2	18
9:00	0	2	0	0	7	0	2	6	0	0	0	17
9:15	0	0	0	0	1	0	0	6	0	0	0	7
Total	***2***	***4***	***2***	***2***	***36***	***1***	***7***	***40***	***1***	***1***	***2***	***98***

TABLE A2
PM Peak-Hour Bicycle Traffic Volume Changes
Selected Intersections, Minuteman Corridor
9/24/80, 10/1/85, 9/26/90, 9/28/93

Location	Percent Change		
	1980-1985	1985-1990	1990-1993
Cambridge			
Porter Square	34	8	-10
Arlington			
Mass. Ave. at Alewife Br.	6	-11	-5
Arlington Center	1	-20	39
Belmont			
Concord Ave. at Blanchard	-54	-38	-62
Lexington			
Mass. Ave. at Marrett Rd.	-18	-5	-63
Bedford			
Hartwell at Rtes. 4-225	-54	91	-58
Hartwell at Maguire Rd.	-64	220	-18
Totals	**-3**	**-1**	**-0**

APPENDIX B

Minuteman-Charles River Connector Study
Bicyclist Survey

Where did you begin this bicycle trip? (nearest street intersection, or MBTA stop, town)

_____

Where will you end this bicycle trip? (nearest street intersection, or MBTA stop, town)

_____

If bicycle portion ends at MBTA stop, where will entire trip end? _____
(or if bicycle portion begins at MBTA, where did entire trip begin?)_____

Purpose of this trip:

22 work
___ school
___ shopping
1 personal business
8 recreation
___ social
2 other

Length of cycling portion of trip_____ miles

Elapsed time of cycling portion:_____minutes
Elapsed time of entire trip:_____minutes

How many days per week do you cycle for:		1	2	3	4	5	6	7
work/school	_____	1		4	6	7	1	
shop/personal business/social	_____			1				4
recreational	_____	6	3	4	1	2		3
other	_____							

How many months a year do you cycle? 3-1 4-1 6-6 7-1 8-3 9-6 12-4

Before the Minuteman was built, how did you make this trip?

5 Didn't 7 Bicycled on-road. Give route_____
__ Walked 3 Transit. Give routes/line: _____
7 Drove car __ Car passenger __ Other_____

Age 0 <20 13 30-39 3 50-59 0 >70
6 20-29 9 40-49 2 60-69

Sex 24 M 11 F

How often do you wear a helmet? (Wearing a helmet? 21 yes 13 no)

21 always
3 usually---------> when not?_____
3 occasionally--> when?_____
7 never----------> why?_____

Reason for biking on this trip. (Do not offer the choices, allow respondent to volunteer. Rank order the responses, #1 being the most important, or the first mentioned.)

6 fastest alternative
13 most pleasant
24 exercise
6 others_____
3 most convenient
8 no pollution
6 least expensive

If circumstances were such that you couldn't bicycle today, what would you have done?
(Get all portions of trip, driving, walking, transit details, ie, bus stop, transit station)

8__ not made trip 2___ walk
11__ driven alone 1___ driven with a passenger 1___ been driven
14__ transit _____
1__ other_____

Do you have access to an automobile:

18__ Always
1__ Usually
7__ Occasionally
7__ Never

Any bicycle accidents in past 5 years? (Give number if more than one_____) When:_____

5__ Yes: Involving motor vehicle____ bicyclist____ pedestrian____other_____
On a path_____ On a street_____ Other_____
Reported to police? ___ Yes ____ No ____Don't Know
Were you injured? ___ Yes (_ Severe __ Moderate __ Minor) ___No

23___ No

Bicycle stolen in past 5 years? (Include # of times if more than once____). When:_____

6_ Yes: At home ___ Other building ___Outside rack ___Other outside
Bike locked? ___Yes ___No
Reported to police? ___Yes ___No
Did you get bike back? ___Yes ___No

25_ No

Bike registered with police? 3___yes 16___no

Suggestions for connecting Minuteman to Charles River path:

Comments on path (or general comments):

Date:_____ Time:_____